AD _____

EVALUATION OF WEAPONS' COMBUSTION PRODUCTS IN ARMORED VEHICLES

Final Report

Appendix A: Sampling and Analysis Methods

Appendix B: Analytical Data

Kenneth T. Menzies
M. A. Randel
A. L. Quill
Arthur D. Little, Inc.
Acorn Park
Cambridge, Massachusetts 02140-2390

and

MAJ W. C. Roberts
U.S. Army Biomedical Research and Development Laboratory
Fort Detrick, Frederick, Maryland 21701-5010

January 1, 1989

Supported by

U.S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
Fort Detrick, Frederick, Maryland 21701-5012

Contract No. DAMD17-86-C-6245

MAJ J. Y. Young
Contracting Officer's Representative
U.S. Army Biomedical Research and Development Laboratory
Fort Detrick, Frederick, Maryland 21701-5010

Approved for public release; distribution unlimited

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

DISCLAIMER

This program has been funded by the United States Army Medical Research and Development Command under Contract No. DAMD17-86-C-6245 to Arthur D. Little, Inc. It has been subject to review by the U.S. Army Biomedical Research and Development Laboratory. The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents. Mention of trade names or commercial products do not constitute endorsement or recommendation for use.

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Authur D. Little 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Acorn Park Cambridge, Massachusetts 02140-2390	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION U.S. Army Medical Research & Development Command 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER Contract No. DAMD17-86-C-6245
8c. ADDRESS (City, State, and ZIP Code) Fort Detrick Frederick, Maryland 21701-5012	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 62787A; PROJECT NO. 3E1 62787A878; TASK NO. CA; WORK UNIT ACCESSION NO. 285

11. TITLE (Include Security Classification)

Evaluation of Weapons' Combustion Products in Armored Vehicles

12. PERSONAL AUTHOR(S)

Kenneth T. Menzies; M.A. Randel; A.L. Quill; MAJ W.C. Roberts

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final Report, Appendix	FROM 9/30/86 TO 12/14/88	1989 January 1	203

16. SUPPLEMENTARY NOTATION

Appendix A: Sampling and Analysis Methods
Appendix B: Analytical Data

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP
06	14	
19	03	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)

RA III; Combustion Products; Weapon Systems; Personal Sampling; Armored Vehicles; Volunteers,

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The U.S. Army Biomedical Research and Development Laboratory defined an extensive research program to address the generation of potentially toxic propellant combustion products in crew compartments of armored vehicles during weapons firing. The major objectives of the research were (1) to determine the presence and concentration of propellant combustion products, (2) to determine potential crew exposure to these combustion products, and (3) to assess the efficacy of field monitoring in armored vehicles. To achieve these goals, air monitoring was conducted in selected armored vehicle types, i.e., M109, M60, M3, M1, at several Army installations. Auxiliary information concerning the specific munitions fired and the Training and Doctrine Command (TRADOC) or Forces Command (FORSCOM) firing scenarios was collected so that a comparison of pollutant concentrations generated by specific weapons both within vehicle types and between vehicle types could be made.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Mrs. Virginia Miller	301/663-7325	SGRD-RMI-S

DD Form 1473, JUN 86 — Previous editions are obsolete. — SECURITY CLASSIFICATION OF THIS PAGE

19. ABSTRACT (continued)

The characterization of the airborne combustion products in armored vehicles during weapons firing exercises was facilitated by the use of optimized sampling and analysis methods to permit the collection of large sample volumes and thus enhance the ability to identify and quantify trace pollutants. Inorganic gases and members of several compound classes were found in one or more armored vehicles during firing:

WEAPON POLLUTANTS

Carbon Monoxide	Vapor Phase Organics
Ammonia	Aldehydes
Carbon Dioxide	Polycyclic Aromatic Hydrocarbons (PAHs)
Hydrogen Cyanide	Nitro-PAHs
Hydrogen Sulfide	Particulates (Total, Respirable)
Nitrogen Oxides	Metals
Sulfur Dioxide	

On a few occasions, carbon monoxide was observed to exceed the NRC recommended emergency and continuous exposure limit, which is 1500 ppm, for up to 40 minutes in tanks (M1 and M60). Carbon monoxide was observed to exceed 2000 ppm for shorter periods in all vehicles except the M3, where the peak level was 1300 ppm. Mean carbon monoxide concentrations ranged from 3.6 to 4.7 ppm in the non-tank vehicles (M3 and M109) and from 35 to 43 ppm in the tanks. With few exceptions, the maximum concentrations of all other pollutants in all vehicles were less than their respective threshold limit values and short-term emergency exposure levels.

The peak instantaneous concentrations of pollutants generated during weapon firing, and to which crewmen such as the ammunition loader are exposed, may exceed 500 times the average concentrations inside vehicles. These peak excursions are very localized and short-lived. Carbon monoxide, which is a major combustion product, is observed at statistically significantly higher mean and peak concentrations in tanks (M1; M60) compared to non-tank vehicles (M3; M109). All other pollutants are generally observed at higher levels in tanks than non-tank vehicles, although the statistical significance of this observation is affected by sample size and variability.

The rigor and complexity of field sampling in armored vehicles during firing exercises can be successfully dealt with if proper planning and careful limitation of the duration of sampling is followed. The use of sampling vests for breathing zone measurements is feasible although subject to failure due to the activity of the subject.

APPENDIX A

SAMPLING AND ANALYSIS METHODS

FORMULA: Table 1

M.W.: Table 1

POLYNUCLEAR AROMATIC HYDROCARBONS

METHOD: 5506
ISSUED: 5/15/85

OSHA: proposed for B[a]P: 0.2 µg/m³
ACGIH: suspect carcinogen (B[a]P)

PROPERTIES: Table 1

COMPOUNDS:	acenaphthene	benzo[ghi]perylene	fluorene
	acenaphthylene	benzo[a]pyrene	indeno[1,2,3-cd]pyrene
	anthracene	benzo[e]pyrene	naphthalene
	benz[a]anthracene	chrysene	phenanthrene
	benzo[b]fluoranthene	dibenz[a,h]anthracene	pyrene
	benzo[k]fluoranthene	fluoranthene	

SYNONYMS: PAH; PNA; also see Table 2.

SAMPLING

SAMPLER: FILTER + SORBENT
(2-µm, 37-mm PTFE + washed XAD-2, 100 mg/50 mg)

FLOW RATE: 2 L/min

VOL-MIN: 200 L
-MAX: 1000 L

SHIPMENT: transfer filters to culture tubes; wrap sorbent and culture tubes in Al foil; ship @ 0 °C

SAMPLE STABILITY: unknown; protect from heat and UV radiation

FIELD BLANKS: 10% (≥3) of samples
MEDIA BLANKS: 6 to 10

AREA SAMPLES: 8 replicates on preweighed filters for solvent selection

ACCURACY

RANGE STUDIED, BIAS, AND OVERALL PRECISION (s_r): not measured

MEASUREMENT

METHOD: HPLC, FLUORESCENCE/UV DETECTION

ANALYTE: compounds above

EXTRACTION: 5 mL organic solvent appropriate to sample matrix (step 7)

COLUMN: 15 cm x 4.6 mm, reverse phase, 5-µm C_{18}

INJECTION VOLUME: 10 to 50 µL

MOBILE PHASE: H_2O/CH_3CN gradient @ ambient temperature

FLOW RATE: 1.0 mL/min

DETECTORS: UV @ 254 nm; fluorescence @ 340 nm (excitation), 425 nm (emission)

CALIBRATION: external standards in CH_3CN

RANGE, LOD AND PRECISION (s_r): EVALUATION OF METHOD

APPLICABILITY: The working range for B[a]P is 1 to 50 µg/m³ for a 400-L air sample. Specific sample sets may require modification in filter extraction solvent, choice of measurement method, and measurement conditions (see EVALUATION OF METHOD).

INTERFERENCES: Any compound which elutes at the same HPLC retention time may interfere. Heat, ozone, NO_2, or UV light may cause sample degradation.

OTHER METHODS: This revises P&CAM 206 and 251 [1]. The spectrophotometric methods, P&CAM 184 and 186 [1], have not been revised. Also see Method 5515 (GC).

REAGENTS:

1. Filter extraction solvent: benzene,* cyclohexane, methylene chloride, or other appropriate solvents, pesticide grade grade (step 7).
2. Water, distilled, deionized, degassed.
3. Acetonitrile, HPLC grade, degassed.
4. PAH reference standards,* appropriate to the PAH-containing matrix sampled.
5. Calibration stock solution, 0.25 mg/mL.* Check purity of each PAH reference standard by GC/FID, HPLC/fluorescence and/or melting point. Purify, if necessary, by recrystallization. Weigh 25 mg of each PAH into a 100-mL volumetric flask; dilute to volume with acetonitrile. Stable six months if refrigerated and protected from light.

*See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler:
   a. Filter. PTFE-laminated membrane filter, 2-µm pore size, 37-mm diameter (ZEFLOUR, Membrana, Pleasanton, CA or equivalent), backed by a gasket (37-mm OD, 32-mm ID) cut from a cellulose support pad, in cassette filter holder.
      NOTE 1: If sampling is to be done in bright sunlight, use opaque or foil-wrapped cassettes to prevent sample degradation.
      NOTE 2: Take filters to be preweighed from the filter package and allow to equilibrate 24 hrs with laboratory atmosphere before taring.
   b. Sorbent tube, connected to filter with minimum length PVC tubing. Plastic caps are required after sampling. Washed XAD-2 resin (front = 100 mg; back = 50 mg) (Supelco ORBO 43 or equivalent). Pressure drop at 2 L/min airflow 1.6 to 2 kPa (15 to 20 cm H_2O).
2. Personal sampling pump capable of operating for 8 hrs at 2 L/min, with flexible connecting tubing.
3. Aluminum foil.
4. Vial, scintillation, 20-mL, glass, PTFE-lined cap.
5. Refrigerant, bagged.
6. Culture tubes, PTFE-lined screw cap, 13-mm x 100-mm.
7. Forceps.
8. Filters, 0.45-µm, PTFE or nylon (for filtering sample solutions).
9. Pipet, 5-mL.
10. Syringe or micropipets, 1- to 100-µL.
11. Ultrasonic bath.
12. HPLC, with gradient capability, fluorescence (excitation @ 240 nm, emission @ 425 nm) and UV (254 nm) detectors in series, electronic integrator, and column [HC-ODS-SILX (Perkin-Elmer Corp.), Vydac 201TP (The Separations Group) or equivalent; see page 5506-1].
13. Volumetric flasks, 10- and 100-mL.
14. Lighting in laboratory: incandescent or UV-shielded fluorescent.
15. Kuderna-Danish extractor.

SPECIAL PRECAUTIONS: Treat benzene and all polynuclear aromatic hydrocarbons as carcinogens. Neat compounds should be weighed in a glove box. Spent samples and unused standards are toxic waste. Regularly check counter tops and equipment with "black light" for fluorescence as an indicator of contamination by PAH.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Take personal samples at 2 L/min for a total sample size of 200 to 1000 L. Take a concurrent set of eight replicate area samples at 2 to 4 L/min on preweighed, 2-μm PTFE filters in an area of highest expected PAH concentration.
   NOTE: The area samples are needed for solvent selection (step 7).
3. Immediately after sampling, transfer the filter carefully with forceps to a scintillation vial. Hold filter at edge to avoid disturbing the deposit. Cap the scintillation vial and wrap it in aluminum foil.
   NOTE: This step is necessary to avoid loss of analytes due to sublimation and degradation by light.
4. Cap the sorbent tube and wrap it in aluminum foil.
5. Ship to laboratory in insulated container with bagged refrigerant.

SAMPLE PREPARATION:

NOTE: UV light may degrade PAH. Use yellow, UV-absorbing shields for fluorescent lights or use incandescent lighting.

6. Refrigerate samples upon receipt at laboratory.
7. Determine optimum extraction solvent.
   a. Allow the preweighed area filter samples to equilibrate 24 hrs with the laboratory atmosphere.
   b. Weigh the area filters. Determine total weight collected on each.
   c. Extract the first pair of area filters with acetonitrile, the second with benzene, the third with cyclohexane, and the fourth with methylene chloride, according to step 8.
      NOTE: Use alternate solvents, if appropriate. PAH of interest may be entrained within, and adsorbed by, particulate matter collected on the filter. It is necessary to determine the solvent which maximizes recovery of the PAH from each sample matrix. For example, methylene chloride [2,3] and benzene:ethanol (4:1 v/v) [4] have been recommended for extraction of PAH from diesel exhaust particulate.
   d. Analyze the extracts for the PAH of interest (steps 10 through 18). Normalize the total mass of PAH found to the mass of sample collected.
   e. Choose the solvent which gives the highest recovery of PAH of interest. Use the solvent chosen to extract the personal filter samples.
8. Extract filters.
   a. Add 5.0 mL of the solvent chosen in step 7 to each scintillation vial containing a filter. Start media and reagent blanks at this step.
   b. Cap and let sit 15 to 20 min in an ultrasonic bath.
      NOTE 1: Soxhlet extraction may be required when large amounts of highly adsorptive particulate matter (e.g., fly ash or diesel soot) are present.
      NOTE 2: The sample must be dissolved in acetonitrile for chromatography. If needed, perform solvent exchange as follows:
      CAUTION: To avoid loss of volatile components, do not allow the sample to go to dryness at any time.
      (1) After filtration (step 10), take the sample to near dryness in a Kuderna-Danish extractor.
      (2) Add ca. 1 mL acetonitrile, take to near dryness, and adjust final volume to 1.0 mL with acetonitrile and filter again.
9. Desorb PAH from sorbent.
   a. Score each sorbent tube with a file in front of the front (larger) sorbent section. Break tube at score line.

b. Transfer glass wool plug and front sorbent section to a culture tube. Discard the foam plug. Transfer back sorbent section to a second culture tube.
c. Add 5.0 mL acetonitrile to each culture tube. Cap the culture tubes.
d. Allow samples to sit for 30 min. Swirl occasionally.

10. Filter all sample extracts through an 0.45-μm membrane filter.

CALIBRATION AND QUALITY CONTROL:

11. Calibrate daily with at least five working standards.
    a. Dilute aliquots of calibration stock solution with acetonitrile in 10-mL volumetric flasks (e.g., to 2.5, 0.5, 0.1, 0.02, and 0.002 μg/mL).
    b. Intersperse working standards and samples in the measurements.
    c. Prepare calibration graphs (peak area vs. μg of each PAH per sample).
12. Recovery and desorption efficiency.
    a. Determine recovery (R) from filters and desorption efficiency (DE) from sorbent tubes at least once for each lot of filters and sorbent tubes used in the range of interest.
       (1) Filters. Using a microliter syringe or micropipette, spike four filters at each of five concentration levels with a mixture of the analytes. Allow the filters to dry in the dark overnight. Analyze the filters (steps 8, 10, and 14 through 16. Prepare graphs of R vs. amounts found.
           NOTE: This step may not be used for some highly adsorptive particulate matrices for which calibration by the method of standard additions may be more accurate.
       (2) Sorbent tubes. Transfer an unused front sorbent section to a culture tube. Prepare a total of 24 culture tubes in order to measure DE at five concentration levels plus blanks in quadruplicate. Using a microliter syringe or micropipette, add calibration stock solution directly to sorbent. Cap culture tubes and allow to stand overnight. Analyze (steps 9, 10, and 14 through 16). Prepare graphs of DE vs. amounts found.
    b. Check R and DE at two levels for each sample set, in duplicate. Repeat determination of R and DE graphs if checks do not agree to within ±5% of DE graph.
13. Analyze at least three field blanks for each sample medium.

MEASUREMENT:

14. Set HPLC according to manufacturer's recommendations and to conditions on page 5506-1. Equilibrate column at 60% CH_3CN/40% H_2O at 1.0 mL/min for 15 min before injecting first sample.
15. Inject sample aliquot. Start mobile phase gradient:
    a. Linear gradient 60% CH_3CN to 100% CH_3CN, 20 min.
    b. Hold at 100% CH_3CN for 20 min.
       NOTE: Hold longer if necessary to prevent carryover of background, e.g., from coal dust.
    c. Linear gradient to initial condition, 5 min.
16. Measure peak areas.
    NOTE 1: Approximate retention times appear in Table 3.
    NOTE 2: If peak area is above the calibration range, dilute with appropriate solvent, reanalyze, and apply dilution factor in calculations.
    NOTE 3: If sample has many interferences, additional sample cleanup may be necessary. Many cleanup procedures have been published. Liquid-liquid partitioning between cyclohexane and nitromethane [5,6] is widely used, but other techniques may be more appropriate for specific samples.

CALCULATIONS:

17. Read the mass, µg (corrected for R or DE) of each analyte found on the filter (W) and front sorbent (W_f) and back sorbent (W_b) sections, and on the average media blank filter (B) and front sorbent (B_f) and back sorbent (B_b) sections from the calibration graphs.
18. Calculate concentration, C ($\mu g/m^3$), in air as the sum of the particulate concentration and the vapor concentration using the actual air volume sampled, V (L).

$$C = \frac{(W - B + W_f + W_b - B_f - B_b) \cdot 10^3}{V}, \ \mu g/m^3$$

NOTE: W_f and W_b include analyte originally collected on the filter as particulate, then volatilized during sampling. This can be a significant fraction for many PAH (e.g., fluoranthane, naphthalene, fluorene, anthracene, phenanthrene).

EVALUATION OF METHOD:

The fluorescence detector used in this method is both sensitive and selective. The detector can "see" as little as 50 pg of many PAH injected on the column. LODs for the 17 analytes range from 50 to 350 ng per sample. It does not respond to non-fluorescent molecules such as aliphatics. The method is, therefore, most amenable to determination of trace amounts of PAH in mixtures of aliphatic compounds. Successful applications include: aluminum reduction facilities, asphalt fume, coal gasification plants, coal liquefaction plants, coal tar pitch, coke oven emissions, creosote treatment facilities, diesel exhaust, graphite electrode manufacturing, petroleum pitch, and roofing tearoff operations.

This method has been evaluated by analyzing spiked filters, spiked sorbent tubes, and complete spiked sampling trains through which were drawn 500 L of air [7]. Each of the three groups was spiked with each analyte at two concentration levels in sextuplicate. Particular note should be made that the effect of particulate matter has not been evaluated, and every sampling matrix is unique. The data on the following page were obtained on spiked samplers stored refrigerated in the dark for three months followed by measurement with HPLC.

COMPOUND	CALIBRATION RANGE (µg per sample)	LOD (µg per sample)	MEASUREMENT PRECISION SPIKED[a]	SPIKED + AIR[b]
1. ACENAPHTHENE	2.0 - 13	0.8	.058 S	.093 (50)
2. ACENAPHTHYLENE	1.0 - 100	0.35	.032 S	.075 (100)
3. ANTHRACENE	0.4 - 13	0.05	.039 S	.037 (5)
4. BENZ[a]ANTHRACENE	0.4 - 13	0.15	.032 F	.084 (5)
5. BENZO[b]FLUORANTHENE	0.4 - 12	0.1	.027 F	.028 (10)
6. BENZO[k]FLUORANTHENE	0.4 - 13	0.15	.025 F	.027 (1)
7. BENZO[ghi]PERYLENE	0.5 - 25	0.2	.031 F	.029 (10)
8. BENZO[a]PYRENE	0.4 - 14	0.2	.027 F	.029 (5)
9. BENZO[e]PYRENE	0.5 - 13	0.2	(c)	(c)
10. CHRYSENE	0.4 - 12	0.15	.039 F	.024 (5)
11. DIBENZ[a,h]ANTHRACENE	0.5 - 25	0.2	.026 F	.029 (10)
12. FLUORANTHENE	0.4 - 13	0.15	.026 S	.050 (10)
13. FLUORENE	0.7 - 13	0.25	.031 S	.090 (10)
14. INDENO[1,2,3-cd]PYRENE	0.5 - 12	0.2	.044 F	.032 (10)
15. NAPHTHALENE	0.6 - 13	0.25	.041 S	.125 (50)
16. PHENANTHRENE	0.4 - 13	0.1	.036 S	.070 (2)
17. PYRENE	0.5 - 13	0.2	(c)	(c)

[a]RSD for filter (F) where volatilization is nil or for sorbent (S) where substantial volatilization may occur during sampling.

[b]RSD determined at the µg level shown in parenthesis for a spiked filter followed by a sorbent tube. After spiking, laboratory air was drawn through the sampling train at 2 L/min for 4 hrs.

[c]Not determined.

REFERENCES:

[1] NIOSH Manual of Analytical Methods, 2nd ed., Vol. 1, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).

[2] Breuer, G. M. Anal. Lett., 17(A11), 1293-1306 (1984).

[3] Zweidinger, R. B., S. B. Tejada, D. Dropkins, J. Huisingh, and L. Claxton. "Characterization of Extractable Organics in Diesel Exhaust Particulate," paper presented at Symposium on Diesel Particulate Emissions Measurement Characterization, Ann Arbor, MI (1978).

[4] Swarin, S. J. and R. L. Williams. "Liquid Chromatographic Determination of Benzo[a]pyrene in Diesel Exhaust Particulate: Verification of the Collection and Analytical Methods," Polynuclear Aromatic Hydrocarbons: Physical and Biological Effects, Bjorseth, A. and Dennis, Eds., Battelle Press, 771-790 (1980).

[5] Wise, S. A., et al. "Analytical Methods for the Determination of Polycyclic Aromatic Hydrocarbons on Air Particulate Matter," Polynuclear Aromatic Hydrocarbons: Physical and Biological Chemistry, Cooke, Dennis and Fisher, Eds., Battelle Press, 919-929 (1982).

[6] Novotny, M., M. L. Lee and K. D. Bartle. J. Chromatog. Sci., 12, 606-612 (1974).

[7] Backup Data Report for Method 5506, Analytical Report for NIOSH Sequence 4170 (NIOSH, unpublished, March 16, 1984).

[8] Studt., P., Liebigs Ann. Chem., 528 (1978).

[9] Clar, E. Polycyclic Hydrocarbons, Academic Press (1964).

[10] Handbook of Chemistry and Physics, 62nd ed., CRC Press (1982).

METHOD REVISED BY: B. R. Belinky and E. J. Slick, NIOSH/DPSE.

5/15/85

Table 1. Formulae and physical properties.

COMPOUND (by M.W.)	EMPIRICAL FORMULA	MOLECULAR WEIGHT	DETECTOR	MELTING POINT (°C)	BOILING POINT (°C)*	REF.
1. NAPHTHALENE	$C_{10}H_8$	128.17	UV	80	218	[9]
2. ACENAPHTHYLENE	$C_{12}H_8$	152.20	UV	92-93	265-275	[10]
3. ACENAPHTHENE	$C_{12}H_{10}$	154.21	UV	96.2	279	[10]
4. FLUORENE	$C_{13}H_{10}$	166.22	UV	116	293-295	[9]
5. ANTHRACENE	$C_{14}H_{10}$	178.23	UV	218	340	[9]
6. PHENANTHRENE	$C_{14}H_{10}$	178.23	UV	100	340	[9]
7. FLUORANTHENE	$C_{16}H_{10}$	202.26	FL	110	—	[9]
8. PYRENE	$C_{16}H_{10}$	202.26	FL	156	399	[9]
9. BENZ[a]ANTHRACENE	$C_{18}H_{12}$	228.29	FL	158-159	--	[9]
10. CHRYSENE	$C_{18}H_{12}$	228.29	UV	255-256	--	[9]
11. BENZO[b]FLUORANTHENE	$C_{20}H_{12}$	252.32	FL	168	--	[9]
12. BENZO[k]FLUORANTHENE	$C_{20}H_{12}$	252.32	FL	217	480	[10]
13. BENZO[a]PYRENE	$C_{20}H_{12}$	252.32	FL	177	--	[9]
14. BENZO[e]PYRENE	$C_{20}H_{12}$	252.32	FL	178-179	--	[9]
15. BENZO[ghi]PERYLENE	$C_{22}H_{12}$	276.34	FL	273	--	[9]
16. INDENO[1,2,3-cd]PYRENE	$C_{22}H_{12}$	276.34	FL	161.5-163	--	[8]
17. DIBENZ[a,h]ANTHRACENE	$C_{22}H_{14}$	278.35	FL	262	--	[9]

*Many of these compounds will sublime.

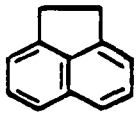
Table 2. Synonyms.

COMPOUND (alphabetically)	SYNONYMS
1. ACENAPHTHENE	CAS# 83-32-9
2. ACENAPHTHYLENE	CAS# 208-96-8
3. ANTHRACENE	CAS# 120-12-7
4. BENZ[a]ANTHRACENE	1,2-benzanthracene; benzo[b]phenanthrene; 2,3-benzophenanthrene; tetraphene; CAS# 56-55-3
5. BENZO[b]FLUORANTHENE	3,4-benzofluoranthene; 2,3-benzofluoranthene; benz[e]acephenanthrylene; B[b]F; CAS# 205-99-2
6. BENZO[k]FLUORANTHENE	11,12-benzofluoranthene; CAS# 207-08-9
7. BENZO[ghi]PERYLENE	1,12-benzoperylene; CAS# 191-24-2
8. BENZO[a]PYRENE	3,4-benzopyrene; 6,7-benzopyrene; B[a]P; BP; CAS# 50-32-8
9. BENZO[e]PYRENE	1,2-benzopyrene; 4,5-benzopyrene; B[e]P; CAS# 192-97-2
10. CHRYSENE	1,2-benzophenanthrene; benzo[a]phenanthrene; CAS# 218-01-9
11. DIBENZ[a,h]ANTHRACENE	1,2,5,6-dibenzanthracene; CAS# 53-70-3
12. FLUORANTHENE	benzo[jk]fluorene; CAS# 206-44-0
13. FLUORENE	CAS# 86-73-7
14. INDENO[1,2,3-cd]PYRENE	2,3-phenylenepyrene; CAS# 193-39-5
15. NAPHTHALENE	naphthene; CAS# 91-20-3
16. PHENANTHRENE	CAS# 85-01-8
17. PYRENE	benzo[def]phenanthrene; CAS#129-00-0

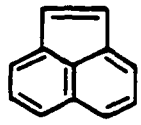
Table 3. Approximate PAH retention times.

COMPOUND	RETENTION TIME (min)*
1. NAPHTHALENE	2.4
2. ACENAPHTHALENE	2.8
3. ACENAPHTHENE	3.6
4. FLUORENE	3.9
5. PHENANTHRENE	4.7
6. ANTHRACENE	5.8
7. FLUORANTHENE	6.8
8. PYRENE	7.7
9. BENZ[a]ANTHRACENE	11.2
10. CHRYSENE	12.1
11. BENZO[e]PYRENE	14.0
12. BENZO[b]FLUORANTHENE	14.8
13. BENZO[k]FLUORANTHENE	16.5
14. BENZO[a]PYRENE	17.3
15. DIBENZ[a,h]ANTHRACENE	20.0
16. BENZO[ghi]PERYLENE	20.0
17. INDENO[1,2,3-cd]PYRENE	21.2

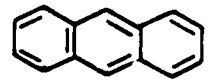
*NOTE: Determined with a Perkin-Elmer HC-ODS-SILX column. Actual retention times will vary with individual columns and column age.



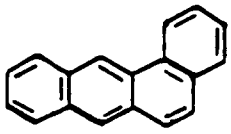
ACENAPHTHENE



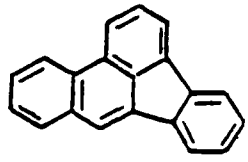
ACENAPHTHYLENE



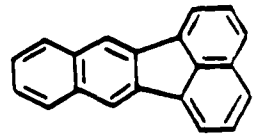
ANTHRACENE



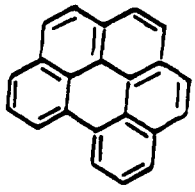
BENZ(a)ANTHRACENE



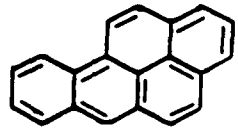
BENZO(b)FLUORANTHENE



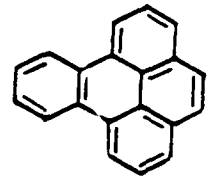
BENZO(k)FLUORANTHENE



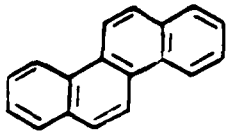
BENZO(g h i)PERYLENE



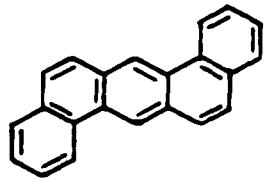
BENZO(a)PYRENE



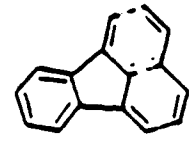
BENZO(e)PYRENE



CHRYSENE

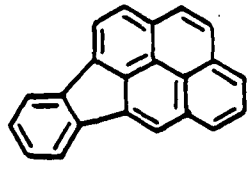


DIBENZ(a,h)ANTHRACENE

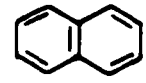


FLUORANTHENE

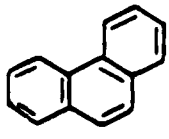
FLUORENE



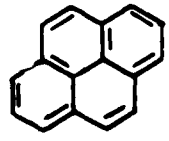
INDENO(1,2,3-c d)PYRENE



NAPHTHALENE



PHENANTHRENE



PYRENE

Figure 1. Structures of PAH.

This page intentionally blank.

ORGANICS SAMPLING AND ANALYSIS METHOD

INSTRUCTIONS FOR USING GC/MS TUBES

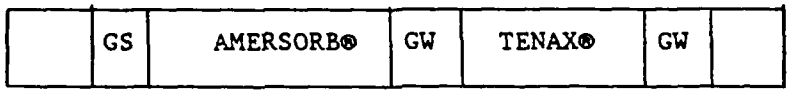
A. PREPARATION OF GC/MS AIR SAMPLE TUBES

1. Cut 6 mm O.D. Pyrex tubing into 7 ± 1/16 inch lengths.

2. Fire polish both ends of each length.

3. Check to ensure that each length will fit into the appropriate concentrator. Glass tubing is not perfectly uniform, so some lengths may fit and others may not. Before inserting the tubes into the concentrator, wipe them clean with a Kimwipe®

4. Using 65 mg (1 1/2 inch) of 20/35 mesh Tenax® GC and 140 mg (1 inch) of Ambersorb® 340 (Rohm and Haas) fill the tube as indicated by the following diagram:



The Ambersorb must be at least 2 inches from the end of the tube. the adsorbents are retained and separated in the tube using silanized (DMCS) treated glass wool plugs. The glass wool (GW) prevents any shifting of the adsorbents at sampling flow rate.

5. Check the pressure drop across each tube and pack the glass wool such that the pressure drop across each tube is approximately equal.

6. Condition each tube for at least 2 hours at 270 ± 10°C while passing 25 ± 5 mL/minute of nitrogen or helium (ultra high purity) through the tube in the direction from Ambersorb® to Tenax®.

7. After the tube is conditioned, care must be taken in handling the tube. Use a Kimwipe® when handling; do not handle the tube by hand. Also, avoid exposing it to organic vapors, e.g., solvents, cigarette smoke, hand lotion, etc.

8. After disconnecting the tube form the oven chamber, insert either end into a clean, dry 200 mm long, screw cap test tube. Two sheets of 5x8 1/2" Kimwipe® should first be inserted into the test tube and compressed to the bottom of the tube to provide a snug fit of the air sample tube and test tube after the screw cap is tightened.

9. These sample tubes can be reused. Before they are reused, make sure there are no gaps in the adsorbents, check step 4, and then repeat steps 5, 6, 7, and 8.

B. SAMPLING

1. Mark several tubes as "FIELD BLANK - DO NOT USE." These are control tubes used to indicate contamination in handling or storage and should <u>not</u> be opened or used in sampling.

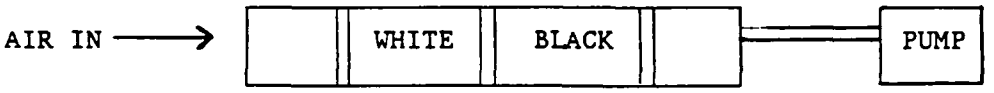
2. Use one tube as a "CALIBRATION TUBE." This tube can be used for calibrating pumps. Also, do <u>not</u> use the tube for actual sampling of air streams.

3. "SAMPLE TUBE." Do not handle the glass portion of the tube by hand. Use a Kimwipe® or equivalent for handling.

   a. Obtain three samples per individual using a low flow air sampling pump and triple variable flow controller manifold. Adjust the manifold to provide 50 mL/min at each tube holder (each manifold inlet can be adjusted and calibrated independently).

b. Keep the sample tubes in the screw cap test tube until just before sampling and return them to the test tube as soon as possible after sampling. Close the screw cap tightly. Affix labels identifying the tubes on the outer screw cap tube rather than the actual GC/MS tube.

c. It is essential to attach the tubes to the pump with the dark adsorbent adjacent to the pump as shown below:



4. While GC/MS tubes are a powerful tool for detecting a large number of organic compounds in air, these tubes are <u>not</u> universal samplers. Certain compounds such as formaldehyde, carbon monoxide, and hydrochloric acid for example cannot be collected and/or detected with these tubes.

C. GC/MS PROCEDURE FOR ANALYSIS OF AIR SAMPLE TUBES

1. The tubes are kept refrigerated until analysis.

2. The tubes are taken one at a time from the refrigerator. One microliter of a 3-component spike mixture is added to the Tenax GC adsorbent using a syringe and the tube is inserted into a concentrator unit. (The spike mixture assures that the analysis is performed satisfactorily.)

3. The tube is thermally desorbed at 270°C and products given off the tube are directed to a capillary gas chromatographic column programmed from 20°C to 280°C at 5°C/min.

4. The column effluent is passed to a mass spectrometer/data system capable of scanning a 20-400 amu mass range each second and storing the mass spectral information for subsequent data analysis.

This page intentionally blank.

ELEMENTS (ICP)

ELEMENTS (ICP)

METHOD: 7300
M.W.: Table 1 ISSUED: 2/15/84

OSHA/NIOSH/ACGIH: Table 1 PROPERTIES: Table 1

ELEMENTS:	aluminum	cobalt	manganese	silver	tungsten
	arsenic	copper	molybdenum	sodium	vanadium
	beryllium	iron	nickel	tellurium	yttrium
	cadmium	lead	phosphorus	thallium	zinc
	calcium	lithium	platinum	tin	zirconium
	chromium	magnesium	selenium	titanium	

SYNONYMS: vary depending upon the compound.

SAMPLING

SAMPLER: FILTER
(0.8-µm, cellulose ester membrane)

FLOW RATE: 1 to 4 L/min

VOL-MIN: Table 1
-MAX: Table 1

SHIPMENT: routine

SAMPLE STABILITY: stable

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: not studied

BIAS: none identified

OVERALL PRECISION (s_r): not evaluated

MEASUREMENT

TECHNIQUE: INDUCTIVELY COUPLED ARGON PLASMA, ATOMIC EMISSION SPECTROSCOPY

ANALYTE: elements above

ASHING REAGENTS: conc. HNO_3, 4 mL; and conc. $HClO_4$, 1 mL
CONDITIONS: room temperature, 30 min; 150 °C to near dryness

FINAL SOLUTION: 4% HNO_3, 1% $HClO_4$, 10 mL

WAVELENGTH: depends upon element; Table 2

BACKGROUND CORRECTION: spectral wavelength shift

CALIBRATION: elements in 4% HNO_3, 1% $HClO_4$

RANGE: 2.5 to 1000 µg per sample [1]

ESTIMATED LOD: 1 µg per sample [1]

PRECISION (s_r): Table 2

APPLICABILITY: The working range of this method is 0.005 to 2.0 mg/m³ for each element in a 500-L air sample. This is simultaneous elemental analysis, not compound specific. Verify that the types of compounds in the samples are soluble with this ashing procedure.

INTERFERENCES: Spectral interferences are the primary interferences encountered in ICP-AES analysis. These are minimized by judicious wavelength selection, interelement correction factors and background correction [1,2].

OTHER METHODS: This method replaces P&CAM 351 [2] for trace elements. Atomic absorption spectroscopy (e.g., Methods 70XX) is an alternate analytical technique for many of these elements.

REAGENTS:

1. Nitric acid, conc.
2. Perchloric acid, conc.*
3. Ashing acid: 4:1 (v/v) HNO_3:$HClO_4$. Mix 4 volumes conc. HNO_3 with 1 volume conc. $HClO_4$.
4. Calibration stock solutions, 1000 µg/mL. Commercially available, or prepared per instrument manufacturer's recommendation (see step 12).
5. Dilution acid, 4% HNO_3, 1% $HClO_4$. Add 50 mL ashing acid to 600 mL water; dilute to 1 L.
6. Argon.
7. Distilled,deionized water.

*See Special Precautions.

EQUIPMENT:

1. Sampler: cellulose ester membrane filter, 0.8-µm pore size, 37-mm diameter; in cassette filter holder.
2. Personal sampling pump, 1 to 4 L/min, with flexible connecting tubing.
3. Inductively coupled plasma-atomic emission spectrometer, equipped as specified by the manufacturer for analysis of elements of interest.
4. Regulator, two-stage, for argon.
5. Beakers, Phillips, 125-mL, or Griffin, 50-mL, with watchglass covers.*
6. Volumetric flasks, 10- and 100- mL.*
7. Assorted volumetric pipets as needed.*
8. Hotplate, surface temperature 150 °C.

*Clean all glassware with conc. nitric acid and rinse thoroughly in distilled water before use.

SPECIAL PRECAUTIONS: Perform all perchloric acid digestions in a perchloric acid hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Sample at an accurately known flow rate between 1 and 4 L/min for a total sample size of 200 to 2000 L (see Table 1) for TWA measurements. Do not exceed a filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

3. Open the cassette filter holders and transfer the samples and blanks to clean beakers.
4. Add 5 mL ashing acid. Cover with a watchglass. Let stand 30 min at room temperature.
   NOTE: Start a reagent blank at this step.
5. Heat on hotplate (120 °C) until ca. 0.5 mL remains.
   NOTE: Some species of Li, Mn, Mo, Sn, W, and Zr will not be completely solubilized by this procedure. Alternative solubilization techniques for most of these elements can be found elsewhere [2,3,4,5,6,7].
6. Add 2 mL ashing acid and repeat step 5. Repeat this step until the solution is clear.
7. Remove watchglass and rinse into the beaker with distilled water.
8. Increase the temperature to 150 °C and take the sample to dryness.
9. Dissolve the residue in 2 to 3 mL dilution acid.
10. Transfer the solutions quantitatively to 10-mL volumetric flasks.
11. Dilute to volume with dilution acid.

CALIBRATION AND QUALITY CONTROL:

12. Calibrate the spectrometer according to the manufacturers recommendations.
    NOTE: Typically, an acid blank and 10 µg/mL multielement working standards are used. The following multielement combinations are chemically compatible in 4% HNO_3/1% $HClO_4$:
    a. Ag, Ca, Co, Mn, Pb, V, Zn;
    b. Al, Be, Cd, La, Li, Ni, Tl;
    c. As, B, Ba, Mg, Mo, P, Sn;

Table 1. Properties and sampling volumes.

Element (Symbol)	Properties: Atomic Weight	Properties: MP, °C	Permissible Exposure Limits, mg/m³ TWA OSHA/NIOSH/ACGIH	Air Volume @ OSHA, L: MIN	Air Volume @ OSHA, L: MAX
Silver (Ag)	107.87	961	0.01/ — / 0.1	250	2000
Aluminum (Al)	26.98	660	— / — / 10.	5 (g)	100 (g)
Arsenic (As)	74.92	817*	0.5/C 0.002/ 0.2	5	2000
Beryllium (Be)	9.01	1278	0.002/ 0.0005/ 0.002	1250	2000
Calcium (Ca)	40.08	842	5 (b)/ — / 2 (b)	5	200
Cadmium (Cd)	112.40	321	0.2/ 0.04/ 0.05	13	2000
Cobalt (Co)	58.93	1495	0.1/ — / 0.1	25	2000
Chromium (Cr)	52.00	1890	1.0 (c)/ 0.025/ 0.5 (c)	5	1000
Copper (Cu)	63.54	1083	1.0/ — / 1.0	5	1000
Iron (Fe)	55.85	1535	10 (b)/ — / 5 (b)	5	100
Lithium (Li)	6.94	179	0.025 (d)/ — / 0.025 (d)	100	2000
Magnesium (Mg)	24.31	651	15 (b)/ — / 10 (b)	5	67
Manganese (Mn)	54.94	1244	C 5/ — / C 5	5	200
Molybdenum (Mo)	95.94	651	15 (e)/ — / 10 (e)	5	67
Sodium (Na)	22.99	98	2 (f)/ C 2 (f)/ C 2 (f)	13	2000
Nickel (Ni)	58.71	1453	1/ 0.015/ 1 (c)	5	1000
Phosphorus (P)	30.97	44	— / — / 0.1	25 (g)	2000 (g)
Lead (Pb)	207.19	328	0.05/ 0.1/ 0.15	50	2000
Platinum (Pt)	195.09	1769	0.002 (a)/ — / 1 (c)	1250	2000
Selenium (Se)	78.96	217	0.2/ — / —	13	2000
Tin (Sn)	118.69	232	2/ — / 2 (c)	5	500
Tellurium (Te)	127.60	450	0.1/ — / 0.1	25	2000
Titanium (Ti)	47.90	1675	— / — / 10 (b)	5	100
Thallium (Tl)	204.37	304	0.1 (a)/ — / 0.1 (a)	25	2000
Vanadium (V)	50.94	1890	C 0.5/ 1 (c)/ 0.05 (V_2O_5)	5	2000
Tungsten (W)	183.85	3410	— / 5 (e)/ 5 (e)	5 (g)	200 (g)
Yttrium (Y)	88.91	1495	1/ — / 1	5	1000
Zinc (Zn)	65.37	419	5 (b)/ 5 (b)/ 5 (b)	5	200
Zirconium (Zr)	91.22	1852	5/ — / 5	5	200

(a) soluble
(b) oxide
(c) metal
(d) hydride
(e) insoluble
(f) hydroxide
(g) at the ACGIH TLV

d. Cu, Fe, Na, Pt, Sr, Te, Y;
e. Cr, K, Sb, Se, Ti, Zr; and
f. Si, W (distilled water only)

13. Analyze a standard for every ten samples.
14. Check recoveries with at least two spiked media blanks per ten samples.

MEASUREMENT:

15. Set spectrometer to conditions specified by manufacturer.
16. Analyze standards and samples.
    NOTE: If the values for the samples are above the range of the standards, dilute the solutions with dilution acid, reanalyze and apply the appropriate dilution factor in the calculations.

CALCULATIONS:

17. Obtain the solution concentrations for the sample, C_s (µg/mL), and the average media blank, C_b (µg/mL), from the instrument.
18. Using the solution volumes of sample, V_s (mL), and media blank, V_b (mL), calculate the concentration, C (mg/m^3), of each element in the air volume sampled, V (L):

$$C = \frac{C_s V_s - C_b V_b'}{V}, \ mg/m^3.$$

EVALUATION OF METHOD:

Method P&CAM 351 was evaluated in 1981 [1,2]. The precision and recovery data were determined at 2.5 and 1000 µg of each element per sample on spiked filters. The precision and recovery data, instumental detection limits, sensitivity, and analytical wavelengths are listed in Table 2. The values in Table 2 were determined with a Jarrell-Ash Model 1160 ICP operated according to manufacturer's instructions.

REFERENCES:

[1] Hull, R.D. "Multielement Analysis of Industrial Hygiene Samples," NIOSH Internal Report, presented at the American Industrial Hygiene Conference, Portland, Oregon (May 1981).
[2] NIOSH Manual of Analytical Methods, 2nd ed., V. 7, P&CAM 351, U.S. Department of Health and Human Services, Publ. (NIOSH) 82-100 (1981).
[3] Ibid, S341 (Lead).
[4] Ibid, V. 2, S5 (Manganese), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-B (1977).
[5] Ibid, V. 4, P&CAM 271 (Tungsten), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-175 (1978).
[6] Ibid, V. 5, P&CAM 173 (Metals by Atomic Absorption), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 79-141 (1979).
[7] Ibid, V. 3, S183 (Tin), S185 (Zirconium), and S376 (Molybdenum), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).

METHOD REVISED BY: R. DeLon Hull and Mark Millson, NIOSH/DPSE.

Table 2. Measurement procedures and data (a).

Element	Wavelength (nm)	Instrumental LOD (ng/mL)	Sensitivity (Intensity/ µg/mL)	Recovery (%) @ 2.5 µg/ filter (b)	Recovery (%) @ 1000 µg/ filter	Precision (s_r) (N = 3) @ 2.5 µg/ filter	Precision (s_r) (N = 3) @ 1000 µg/ filter
Ag	328.3	26	0.65	111	91	0.02	0.075
Al	308.2	14	0.23	93	100	0.092	0.023
As	193.7	13	0.57	103	99	0.062	0.026
Be	313.0	1.5	1.29	107	90	0.040	0.034
Ca	315.9	10	0.49	99	95	0.036	0.014
Cd	226.5	1.6	0.83	107	99	0.032	0.020
Co	231.2	7.4	0.38	101	95	0.040	0.005
Cr	205.6	1.3	0.50	98	106	0.053	0.016
Cu	324.8	2.1	0.72	98	99	0.036	0.022
Fe	259.9	3.9	0.13	94	97	0.068	0.016
Li	670.8	2.8	0.48	89	95	0.171	0.043
Mg	279.6	24	0.22	105	106	0.084	0.027
Mn	257.6	0.4	0.74	84	93	0.062	0.035
Mo	281.6	7.0	0.18	94	88	0.023	0.049
Na	589.0	10	0.76	(c)	101	(c)	0.045
Ni	231.6	3.4	0.41	105	97	0.027	0.020
P	214.9	22	0.17	(c)	91	(c)	0.056
Pb	220.4	17	0.42	105	95	0.060	0.011
Pt	203.7	15	0.69	106	91	0.041	0.075
Se	190.6	21	0.28	105	97	0.068	0.049
Sn	190.0	64	0.49	74	67	0.33	0.16
Te	214.3	29	0.41	102	94	0.050	0.063
Ti	334.9	1.2	0.55	96	108	0.051	0.029
Tl	190.9	17	0.22	103	99	0.043	0.017
V	310.2	3.2	0.88	99	94	0.043	0.014
W	207.9	13	2.58	35	23	0.053	0.60
Y	371.0	0.8	2.35	99	100	0.015	0.013
Zn	213.9	0.6	0.60	101	94	0.013	0.013
Zr	339.2	1.9	0.88	75	98	0.049	0.008

(a) Values reported were obtained with a Jarrell-Ash Model 1160 ICP; performance may vary with instrument and should be independently verified.

(b) 2.5 µg/filter corresponds to 5 µg/m³ for a 500-L air sample.

(c) Blank levels too high to make accurate determinations

This page intentionally blank.

GLUTARALDEHYDE

FORMULA: $OCH(CH_2)_3CHO$

MW: 100.13

ACGIH: 0.7 mg/m^3 (Ceiling)

SYNONYMS: 1,5-Pentanedial; Glutaric Dialdehyde

GLUTARALDEHYDE

METHOD:

ISSUED:

PROPERTIES: liquid; BP 187-189d

SAMPLING	ANALYSIS
SAMPLER: Sorbent Tube (7 cm x 4 mm ID) Two sections (100-150 mg/50-75 mg) with 5% dinitrophenyl-hydrazine hydrochloride	METHOD: HPLC/UV ANALYTE: Glutaraldehyde dinitrophenyl hydrazone (DNPH)
FLOW RATE: 0.2-1.0 LPM	PREPARATION: Desorb in acetonitrile
VOL-MIN: 3 L VOL-MAX: < 24 L	ANALYSIS: Column-Zorbax ODS Mobile Phase - 60% acetonitrile/40% water ⟶ 15 min 90% acetonitrile/10% water Flow Rate - 1.3 mL/min Detection - UV 365 nm
SHIPMENT: Blue ice	
SAMPLE STABILITY: At least 7 days at 4°C	ANALYTICAL RANGE: 1.5-95 ug/sample
BLANKS: 2 to 10 field blanks per set	ESTIMATED LOD: 0.3 ug/sample
BULK SAMPLE: Not required	ANALYTICAL PRECISION: 8.3% at 1.5 ug 2.1% at 25 ug
ACCURACY	
RANGE STUDIED: 0.130-4.80 mg/m^3	
BIAS: -5.5%	
OVERALL PRECISION: Not available	

APPLICABILITY: The method is very specific for glutaraldehyde among other aldehydes, in the range of 0.130 to 4.80 mg/m^3 for a 3-20 liter sample.

INTERFERENCES: Other aldehydes and ketones react with DNPH but can be resolved from glutaraldehyde by using gradient HPLC conditions.

GLUTARALDEHYDE METHOD:

REAGENTS:

1. Glutaraldehyde, 25 wt % solution in water (Aldrich G400-y or equivalent)
2. 2,4-Dinitrophenylhydrazine (Aldrich Chemical 20% moist or equivalent)
3. Hydrochloric Acid (Reagent Grade, ACS)
4. Water - Distilled, deionized
5. Dichloromethane (HPLC grade)
6. 2,4-Dinitrophenyl-hydrazine·Hydrochloride Solution - The solution is prepared by adding 2.5 g dry DNPH to 1.0 L of 2N HCl. The suspension must be placed on a magnetic stirrer for 1-2 hours to allow complete solution of the DNPH. The solution is then extracted three times with 25 mL dichloromethane.
7. Acetonitrile (HPLC grade)
8. Ethanol (HPLC grade)
9. XAD-2 Resin (Supelpak 20 or equivalent)
10. DNPH·HCl XAD-2 Chemosorbent-Prepare DNPH·XAD-2 chemo-sorbent by coating DNPH·HCl onto the surface of the XAD-2 polymer resin. Prepare the DNPH·HCl by dissolving 2,4-dinitrophenylhydrazine in boiling 4M HCl. When the DNPH has dissolved completely, cool the solution in an ice bath. Collect the yellow crystalline precipitate by filtration through a glass fritted crucible. Recrystallize the precipitate from fresh, hot 4M HCl and dry in a desiccator for about eight hours.
11. Clean the XAD-2 by extracting with dichloromethane in a Soxhlet apparatus.

EQUIPMENT:

Solid Sorbent Collection

1. Glass tubing (6.0 mm OD, 4.0 mm ID)
2. DNPH·HCl-coated XAD-2 (see Reagent Section)
3. Glass wool
4. Rotary evaporator
5. Water bath
6. Ice bath

Solid Sorbent Sample Preparation

7. 3.0 mL pipet, Class A
8. Sample filter (see Sample Prep. Section)
9. Sample vials (see Sample Prep. Section)

HPLC Apparatus

10. Column - DuPont Zorbax ODS 5 um
11. UV Detector - Waters Associates Model 450 Absorbance Detector (or equivalent), 365 nm
12. Varian 5000 LC equipped with a Varian 8055 autosampler.
13. Injector - Rheodyne Model 7126 with 20 uL loop.
14. Integrator - Spectra Physics Minigrator (or equivalent)
15. Recorder - Hewlett Packard 7133A (or equivalent)

12. Coat tne DNPH·HCl onto the XAD-2 in a rotary evaporator. Weigh XAD-2 and place in a distillation flask of the rotary evaporator. Weigh sufficient DNPH·HCL for a 5% coating on the XAD-2 and dissolve it in a 9:1 ethanol:hydrochloric acid (12 M) mixture. Add the yellow solution to the distillation flask with the XAD-2. Attach the distillation and solvent receiving flask to the rotary evaporator. Place a water bath (100°C) under the distillation flask and an ice bath (0°C) under the receiving flask. Apply a vacuum to the evaporator and remove the solvent from the sorbent mixture. Store the sorbent in a sealed container, protected from light. The sorbent appears to be stable for at least 4-5 months.

SAMPLING

Sample Collection and Handling

1. Clean the glass sample tube with water, followed by methanol, and then dichloromethane. Allow it to dry.
2. Clean the glass wool by Soxhlet extraction (12 hours) with dichloromethane.
3. Cut glass tubing in 7.0-10.0 cm lengths.
4. Pack the tubes in the following manner:
   - glass wool plug at the front of the tube
   - 150 mg 5% DNPH·HCl/XAD-2 or 100 mg 5% DNPH·HCl/Supelpak 20
   - glass wool plug
   - 75 mg backup section 5% DNPH·HCl/XAD-2 or 50 mg 5% DNPH·HCl/Supelpak 20
   - glass wool plug at back of tube
5. Flame seal or cap the tubes until ready for use. Calibrate each personal sampling pump with a representative sampler in line.
6. Collect solid sorbent samples at a flow rate of 0.2 L/min or up to 1.0 L/min for at least 15 minutes. Overloading of the tube can often be visually verified by a color change of pale yellow 2,4-dinitrophenylhydrazine·hydrochloride to the respective derivative.
7. After sampling, tightly cap the tubes and cover to protect from exposure to light. Aluminum foil is useful if the tube ends have been capped with Teflon and/or a plastic cap.

SAMPLE PREPARATION

8. For each sample, break the sorbent tube in the area of the glass wool plug separating the front and back sorbent sections to facilitate the emptying of the sorbent tube for analysis. It is desirable to have the tube broken cleanly at the point where the front sorbent section and middle glass wool plug meet. Empty the sorbent and glass wool plug from the front section into a vial followed by the two glass wool plugs and backup section. (Note: The front and back sections can be analyzed separately if desired.) A wooden applicator stick may be used to force the sorbent out if necessary.
9. Pipet 3.0 mL (or whatever volume is necessary) HPLC-grade acetonitrile into the vial.
10. Allow the sample to desorb in the acetonitrile for one hour.
11. If necessary, filter the sample through a 0.5 um Teflon filter with a syringe with Swinex adaptor. Store the filter solution in a vial which is capped with a Teflon-lined, self-sealing septum. NH_4Cl may precipitate out of the filtered samples after approximately 24 hours. The precipitate does not appear to affect the chromatography of the compounds of interest. Precipitation is prevented by pH neutralization of the samples with a dilute NaOH solution prior to the filtration.

CALIBRATION AND STANDARDIZATION

12. Prepare calibration standards of glutaraldehyde derivative (i.e., 2,4-dinitrophenylhydrazone). Prepare the derivative by direct combination of the pure aldehyde with an acidic solution of 2,4-dinitrophenylhydrazine. Add the aldehyde in excess to assure that no underivatized DNPH remains. Extract the derivative with dichloromethane. Remove the dichloromethane under vacuum. Recrystallize the 2,4-dinitrophenylhydrazone from hot ethanol several times, until an acceptable melting point range is determined.
13. Prepare chromatographic standards by dissolving known masses of the hydrazone derivative in acetonitrile. A stock standard mixture of 400 ug/mL is appropriate. Prepare other standards by dilution. The linearity of the detector must be determined over the full available range of detector sensitivities. A concentration range of up to two orders of magnitude is appropriate.
14. Assemble the necessary high pressure liquid chromatographic apparatus and establish operating parameters equivalent to those indicated in Table 1. By injecting calibration standards, establish the sensitivity limit of the detectors and the linear range of the analytical systems.

GLUTARALDEHYDE METHOD:

TABLE 1

HPLC PARAMETERS

Column:	DuPont Zorbax ODS 250 mm x 4.6 mm ID reverse phase
Mobile Phase:	60% CH_3CN/40% H_2O 15 min → 90% CH_3CN/10% H_2O
Flow Rate:	1.3 mL/min
Ultraviolet Detector:	λ365 nm Range: 0.04 AUFS
Recorder:	Speed: 0.5 cm/min Range: 10 mV
Injections:	20 uL
Instruments:	Varian 5000 LC with autosampler Waters 450 UV absorbance detector Spectra physics minigrater Hewlett Packard recorder
Retention Time:	600 seconds
Detection Limit:	0.3 ug/sample

15. Before processing any samples, the analyst should demonstrate, through the analysis of a solvent blank, that all glassware and reagents are interference-free. Each time a new set of samples is analyzed or there is a change in reagents, a solvent blank should be processed as a safeguard against chronic laboratory contamination.
16. Standard quality assurance practices should be used with this method. Laboratory replicates should be analyzed to validate the precision of analysis. Spiked samples should be analyzed to validate the accuracy of the analysis.

ANALYTICAL PROCEDURE

17. Table 1 summarizes the recommended HPLC column materials and operating conditions for the instrument. Included in the table are retention time and sensitivities that should be achieved by this method. An example of the separation achieved by this column is shown in Figure 1 of the Backup Data Report. Calibrate the system daily with standards.
18. Inject 20 uL of the sample extract with a high pressure syringe or a sampling loop. Record the volume injected to the nearest 0.05 uL, and the resulting peak size, in area units.
19. If the peak area exceeds the linear range of the system, dilute the extract and reanalyze.
20. If the peak measurement is hindered by the presence of interferences, other chromatographic conditions may be required.

CALCULATIONS

21. Determine the concentration of glutaraldehyde present in the sample atmosphere as follows:

$$\text{Concentration (ug/L)} = C_e V_e (100)/(460)V_s$$

where C_e = concentration of hydrazone in sample extract (ug/mL)

V_e = volume of extract (mL)

100 = molecular weight of glutaraldehyde (g/mole)

460 = molecular weight of glutaraldehyde 2,4-dinitrophenyl-hydrazone (g/mole)

V_s = volume of air sampled (L)

24.45 = molar volume of air (L) @ 25°C; 760 mm Hg

$$\text{Concentration (ppm)} = C(\text{ug/L}) \times 24.47/M_c$$

GLUTARALDEHYDE METHOD:

EVALUATION OF METHOD

This method was developed and validated with laboratory samples at Arthur D. Little, Inc. The relative standard deviation was determined to be 2.1 to 8.3 percent over the range 0.56 to 1.26 mg/m^3.

REFERENCES

[1] Menzies, K.T., K.J. Beltis and C.M. Wong. "Development of Sampling and Analytical Methods for Toxicants in Diesel Exhaust Streams," Final Report. Bureau of Mines Contract J0308005. March 1983.

[2] Kuwata, D., M. Vebori and Y. Yamasaki. "Determination of Aliphatic and Aromatic Aldehydes in Polluted Airs as their 2,4-Dinitrophenylhydrazones by HPLC." J. Chromat. Sci. 17:264-268, 1979.

[3] Andersson, G., K. Andersson, C. Nilsson and J. Levin. "Chemosorption of Formaldehyde in Amberlite XAD-2 Coated with 2,4-Dinitrophenylhydrazine." Chemosphere 10:823-827, 1979.

[4] Andersson, K., C. Hallgren, J. Levin and C. Nilsson. "Solid Chemosorbent for Sampling Sub-ppm Levels of Acrolein and Glutaraldehyde in Air." Chemosphere 10:275-280, 1981.

METHOD WRITTEN BY: K.T. Menzies, K.J. Beltis, A.C. Roche
Arthur D. Little, Inc.

This page intentionally blank.

FORMALDEHYDE

FORMULA: $H_2C=O$; CH_2O

FORMALDEHYDE

METHOD: 2502
ISSUED: 2/15/84

M.W.: 30.03

OSHA: 3 ppm; C 5 ppm; peak 10 ppm
NIOSH: lowest feasible level [1]
ACGIH: 1 ppm; STEL 2 ppm
(1 ppm = 1.23 mg/m³ @ NTP)

PROPERTIES: gas; BP -19.5 °C;
vapor density 1.067 (air = 1);
explosive range 7 to 73% v/v in air

SYNONYMS: methanal; CAS #50-00-0; Formalin (aqueous 30 to 50% w/v HCHO).

SAMPLING

SAMPLER: SOLID SORBENT TUBE
(2-(benzylamino)ethanol on
Chromosorb 102 or XAD-2,
120 mg/60 mg)

FLOW RATE: 0.01 to 0.05 L/min

VOL-MIN: 1 L @ 3 ppm
-MAX: 15 L

SHIPMENT: routine

SAMPLE STABILITY: 4 weeks @ 25 °C

BLANKS: 2 media blanks and 2 field blanks per set of 10; 6 unopened tubes for DE determination (same lot as samples)

ACCURACY

RANGE STUDIED: 0.55 to 4.7 mg/m³ [2]

BIAS: not significant [2]

OVERALL PRECISION (s_r): 0.061 [2]

MEASUREMENT

TECHNIQUE: GAS CHROMATOGRAPHY, FID

ANALYTE: 3-benzyloxazolidine

DESORPTION: 2 mL isooctane; ultrasonic bath 45 min or shake 4 hr

INJECTION VOLUME: 1 µL, splitless; split vent time 30 sec

TEMPERATURE-INJECTION: 210 °C
-DETECTOR: 220 °C
-COLUMN: 70 °C for 1 min; 10 °C/min; hold @ 200 °C for 11.5 min

GASES-CARRIER: He, 100 kPa, ca 0.5 cm³/min; makeup flow, 29 cm³/min

COLUMN: fused silica capillary, 25 m x 0.2 mm; Carbowax 20M

CALIBRATION: solutions of 3-benzyloxazolidine in isooctane

RANGE: 4 to 60 µg per sample

ESTIMATED LOD: 1 µg per sample [3]

PRECISION (s_r): 0.055 [2]

APPLICABILITY: The working range is 0.3 to 5 mg/m³ (0.25 to 4 ppm) for a 12-L air sample.

INTERFERENCES: Phenol has a retention time close to that of 3-benzyloxazolidine but is baseline-resolved. Acid mists may inactivate the sorbent leading to inefficient collection of formaldehyde.

OTHER METHODS: This method was formerly designated P&CAM 354 [4]. It has improved sample stability and ease of personal sampling compared to Methods 3500 and 3501. Method 3500 (chromotropic acid) is the most sensitive.

2/15/84

REAGENTS:

1. Water, distilled, deionized.
2. Eluent: Isooctane, chromatographic grade, containing 0.025% (v/v) hexadecane or other suitable internal standard.
3. Formalin solution, 37%.*
4. Sulfuric acid, 0.02 N.
5. Sodium hydroxide, 0.01 N.
6. Sodium sulfite, 1.13 M.
7. Toluene, distilled in glass.
8. 2-(benzylamino)ethanol, distilled, 100 to 130 °C at 130 Pa (1 mm Hg).
9. 3-Benzyloxazolidine (see Appendix).
10. Formaldehyde stock solution, 1 mg/mL (see Appendix). Stable at least 3 months.
11. Helium, purified.

*See Special Precautions.

EQUIPMENT:

1. Sampler: glass tube, 10 cm x 4 mm ID, containing a 120-mg front section and 60-mg backup section of 2-(benzylamino)ethanol on either Chromosorb 102 or XAD 2. Sorbent sections are retained and separated by small plugs of glass wool. Pressure drop ca. 0.2 kPa (0.8 inch water) at 50 cm^3/min airflow. Tubes are commercially available or may be prepared according to the Appendix.
2. Personal sampling pump, 0.01 to 0.05 L/min, with flexible connecting tubing.
3. Gas chromatograph, capillary column capability, FID, integrator (page 2502-1).
4. Vials, 4-mL, with plastic screw caps.
5. Ultrasonic bath or mechanical shaker.
6. Pipettes, volumetric, 1-, 5- and 10-mL, with pipet bulb.
7. Flasks, volumetric, 10-mL and 1-L.
8. Burettes, 50-mL.
9. pH meter.
10. Disposable pipettes, 2-mL.
11. Syringe, 10-µL, readable to 0.1 µL.

SPECIAL PRECAUTIONS: Formaldehyde is viewed as a potential occupational carcinogen by NIOSH [1].

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the sampler immediately before sampling. Attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.01 and 0.05 L/min for a total sample size of 1 to 15 L.

   NOTE 1: Sampling rate is limited by the speed of reaction of formaldehyde with the sorbent coating. At 0.10 L/min, appreciable formaldehyde (ca. 25%) is found on the backup section, possibly invalidating the sample. At higher flow rates, formaldehyde concentrations will be grossly underestimated.

   NOTE 2: The presence of acid mists or gases may interfere indirectly by reacting with the 2-(benzylamino)ethanol to form amine salts which are not reactive with formaldehyde. If a sufficient amount of the 2-(benzylamino)ethanol is consumed by the acid, formaldehyde concentrations found with the method may be lower than the true concentrations.
4. Cap the samplers with plastic (not rubber) caps and pack securely for shipment.

SAMPLE PREPARATION:

5. Score each sampler with a file in back of the rear sorbent section.
6. Break sampler at score line. Remove and place glass wool plug and rear sorbent section in a vial.
7. Transfer front section with the remaining glass wool plugs to a vial.

8. Add 2.0 mL eluent to each vial. Screw cap tightly onto each vial.
9. Agitate vials in an ultrasonic bath for at least 45 min or in a shaker for 4 hr.

CALIBRATION AND QUALITY CONTROL:

10. Calibrate daily with at least five working standards.
    a. Add known amounts of 3-benzyloxazolidine to eluent in 10-mL volumetric flasks and dilute to the mark.
       NOTE: Prepare standard solutions for splitless injection in the range 1 to 50 µg/mL; for split injection, in the range 1 to 400 µg/mL.
    b. Analyze together with samples and blanks (steps 13 and 14).
    c. Prepare calibration graph (ratio of peak area or height of analyte to peak area or height of internal standard vs. µg 3-benzyloxazolidine) for the injection technique used.
11. Determine desorption efficiency (DE) at least once for each batch of charcoal used for sampling in the calibration range (step 10). Prepare three tubes at each of five levels plus three media blanks.
    a. Remove and discard back sorbent section of a media blank sampler.
    b. Inject a known amount of formaldehyde stock solution directly onto front sorbent section with a microliter syringe.
    c. Cap the tube. Allow to stand overnight.
    d. Desorb (steps 5 through 9) and analyze together with working standards (steps 13 and 14).
    e. Prepare a graph of DE vs. µg 3-benzyloxazolidine recovered.
12. Analyze three quality control blind spiked and three analyst spikes to insure that the calibration graph and DE graph are in control.

MEASUREMENT:

13. Set gas chromatograph to conditions given on page 2502-1. Set air and hydrogen flows on the flame ionization detector to manufacturer's specifications. Inject 1-µL sample aliquot via the splitless injection technique. t_r = 11.5 min for these conditions.
    NOTE: If sample amount of 3-benzyloxazolidine overloads the column (> 50 ng/µL for 0.2 mm ID column), either dilute sample with eluent or inject via split injection technique, reanalyze, and apply appropriate volume correction factor in calculations. Column overloading is indicated by a plateau on the calibration graph at high concentrations. If split injection is required, the following conditions are typical:

Column temperature program:	150 °C for 7 min; 10 °C/min; hold at 200 °C
Split flow rate:	10 cm^3/min He
Retention time:	5.9 min

14. Measure peak area or height. Divide the peak area or height of analyte by the peak area or height of internal standard on the same chromatogram.

CALCULATIONS

15. Determine the mass, µg (corrected for DE) of 3-benzyloxazolidine found in the sample front (W_f) and back (W_b) sorbent sections, and in the average media blank front (B_f) and back (B_b) sorbent sections.
    NOTE 1: If $W_b > W_f/10$, report breakthrough and possible sample loss.
    NOTE 2: A blank level of 1 to 7 µg HCHO is typical. Measure sufficient media blanks (at least 2 per 10 samples) to determine a representative mean value.

16. Multiply by the desorption volume (2 mL) and the conversion factor (0.184) from 3-benzyloxazolidine to formaldehyde to calculate concentration, C, of formaldehyde in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 2\ mL \cdot 0.184}{V}, \ mg/m^3.$$

EVALUATION OF METHOD

Side-by-side comparisons of this method using laboratory-prepared samplers with a 2,4-dinitrophenylhydrazine-coated silica gel tube method [5] were done in a formaldehyde production facility. Means of the two methods were not significantly different [6]. Lab testing with spiked samplers and atmospheres generated by syringe pump/air dilution [2]; verified by 2,4-dinitrophenylhydrazine-coated silica gel tubes [5]. Breakthrough volume of laboratory-prepared samplers (80% RH, 6 mg HCHO/m^3, 0.05 L/min) was greater than 16 L; DE (10.5, 37.5, 76.0 µg per sample) = 99%; recovery after storage (0.85 µg per sample) = 94.3% after two weeks at 25 °C; precision and accuracy as given on page 2502-1 (24 samples). When acetaldehyde was present as a cocontaminant, 5% breakthrough volume was 16 L (80% RH, 10 mg HCHO/m^3, 10 mg acetaldehyde/m^3, 0.05 L/min). Sampling rate influences reaction of formaldehyde with the sorbent coating. Rates above 0.05 L/min give low results with laboratory-prepared samplers.

In a breakthrough study done using commercially-available tubes, the breakthrough volume was found to be greater than 73 L at 8.7 mg/m^3 and greater than 58 L at 28 mg/m^3 of formaldehyde. These atmospheres were sampled at 0.078 L/min.

An atmosphere of 0.36 mg/m^3 formaldehyde, as determined by P&CAM 125 [7], was sampled with sets of six tubes at ca. 0.08 L/min for 70 min, 286 min and 482 min. The average amount indicated by these tubes was 0.32 mg/m^3 with the relative standard deviation less than 10% in all cases. The tube loadings for these sampling periods were 1.6, 6.3 and 10.8 ug. This information indicates that concentrations as low as 0.1 mg/m^3 should be measurable with a sampling rate of 0.08 L/min and a sampling time of 8 hrs.

REFERENCES:

[1] NIOSH Current Intelligence Bulletin 34, "Formaldehyde: Evidence of Carcinogenicity," U.S. Department of Health and Human Services, Publ. (NIOSH) 81-111 (1981).
[2] Kennedy, E. R. and R. H. Hill, Jr. Anal. Chem., 54, 1739-1742 (1982).
[3] User check, UBTL, NIOSH Sequence #3990-Y (unpublished, November 21, 1983).
[4] NIOSH Manual of Analytical Methods, 2nd ed., V. 7, P&CAM 354, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 82-100 (1982).
[5] Beasley, R. K., C. E. Hoffmann, M. L. Reuppel and J. W. Worley. Anal. Chem., 52, 1110-1114 (1980).
[6] Smith, D. L., M. Bolyard and E. R. Kennedy. Am. Ind. Hyg. Assoc. J., 44, 97-99 (1983).
[7] NIOSH Manual of Analytical Methods, 2nd ed., V. 1, P&CAM 125, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977). P&CAM 125 appears as Method 3500 in this Manual.

METHOD WRITTEN BY: Eugene R. Kennedy, Ph.D., and Robert H. Hill, Jr., Ph.D., NIOSH/DPSE.

APPENDIX:

SAMPLING TUBE PREPARATION

Extract Chromosorb 102 or XAD-2 with a 50/50 (v/v) mixture of acetone/methylene chloride in a soxhlet apparatus for 4 hrs using a 30-min cycle time. Vacuum dry [1 mm Hg (133 Pa)] the sorbent at ambient temperature overnight. To a slurry of the dried, extracted sorbent (10 g in 100 mL toluene), add 1 g distilled 2-(benzylamino)ethanol in 10 mL toluene. Allow to stand for 1 hr with occasional swirling. Remove the solvent by rotary evaporation and vacuum dry [1 mm Hg (133 Pa)] at ambient temperature overnight. For each batch of the coated sorbent, desorb several 100-mg portions with isooctane and analyze. If the background is greater than 7 µg 3-benzyloxazolidine/100 mg coated sorbent, discard the batch.

PREPARATION OF 3-BENZYLOXAZOLIDINE

Add a solution of 1.51 g (10 mmole) 2-(benzylamino)ethanol in 10 mL toluene dropwise to a solution of 1 mL 37% formalin (0.37 g formaldehyde, 12.3 mmole) in 25 mL toluene. Stir 1 hr. Remove the solvent at reduced pressure by rotary evaporation. The product is a yellow viscous oil. Vacuum distill at 58 to 62 °C at 1 mm Hg (133 Pa); yields 3-benzyloxazolidine as a clear, colorless oil, stable at room temperature for several months in a closed vial.

PREPARATION AND STANDARDIZATION OF FORMALDEHYDE STOCK SOLUTION (ca. 1 mg/mL)

Dilute 2.7 mL 37% formalin solution to 1 L with distilled, deionized water. This solution is stable at least three months. Standardize as follows:

Place 5.0 mL 1.13 N sodium sulfite solution in a beaker, stirred with a magnetic stirrer. Adjust pH to between 7 and 9 with base or acid. Record the pH. Add 10.0 mL stock formaldehyde solution. The pH should now be about 12. Titrate the solution back to its original pH with 0.02 N sulfuric acid (1 mL acid = 0.600 mg HCHO; about 17 mL acid needed). If the endpoint pH is overrun, back titrate to the endpoint with 0.01 N sodium hydroxide. Calculate the concentration, C_s (mg/mL), of the formaldehyde stock solution:

$$C_s = \frac{30.0 \cdot [(N_a \cdot V_a) - (N_b \cdot V_b)]}{V_s}$$

where: 30.0 = 30.0 g/equivalent of formaldehyde
N_a = normality of sulfuric acid
V_a = volume of sulfuric acid (mL) used for titration
N_b = normality of NaOH
V_b = volume of NaOH (mL) used for back titration
V_s = volume of HCHO stock solution (10.0 mL).

This page intentionally blank.

NITROGEN DIOXIDE - BREATHING ZONE

FORMULA: NO_2

M.W.: 46.01

NITROGEN DIOXIDE

METHOD: 6700
ISSUED: 2/15/84

OSHA: C 5 ppm
NIOSH: 1 ppm/15 min [1]
ACGIH: 3 ppm; STEL 5 ppm
(1 ppm = 1.881 mg/m³ @ NTP)

PROPERTIES: dark brown fuming liquid or gas; BP 21 °C; MP -11 °C

SYNONYMS: nitrogen peroxide, CAS #10102-44-0.

SAMPLING

SAMPLER: PASSIVE
(Palmes tube with three triethanolamine-treated screens [2])

SAMPLING TIME-MIN: 15 min @ 5 ppm
-MAX: 8 hr @ 10 ppm

SHIPMENT: routine

SAMPLE STABILITY: use sampler within 1 month after preparation; analyze within 1 month after sampling

BLANKS: 5 field blanks per sample set

ACCURACY

RANGE STUDIED: 1.2 to 80 ppm-hrs (0.13 to 8.5 µg NO_2 per sample) [3]

BIAS: complete conversion of nitrogen dioxide to nitrite (Saltzman factor = 1) [2]; slightly lower collection efficiency at lower pressure (-7% at 5,500 m altitude) [4]

OVERALL PRECISION (s_r): 0.06 [5]

MEASUREMENT

TECHNIQUE: VISIBLE ABSORPTION SPECTROPHOTOMETRY

ANALYTE: nitrite ion (NO_2^-)

REAGENT: aqueous solution of sulfanilamide, H_3PO_4 and N-1-naphthylethylene-diamine dihydrochloride

WAVELENGTH: 540 nm

PATHLENGTH: 1 cm

CALIBRATION: solutions of $NaNO_2$ in reagent

RANGE: 0.13 to 8.5 µg NO_2 per sample [3]

ESTIMATED LOD: 0.01 µg NO_2 per sample

PRECISION (s_r): 0.05 [3]

APPLICABILITY: The working range is 1.2 to 80 ppm-hrs [3].

INTERFERENCES: In very dusty environments, particles may deposit on the inside surface of the samplers. Resuspension of the dust in the analytical reagent can give a positive bias in the spectrophotometric reading.

OTHER METHODS: Short-term, long-term, and passive indicator tubes, and various other passive samplers and electrochemical instruments are used. P&CAM 231 [6] and S320 [8] are active solid sorbent sampling methods using similar color development; P&CAM 108 [7] uses a bubbler.

REAGENTS:

1. Absorbing reagent. 1 volume triethanolamine (TEA) diluted in 7 volumes analytical grade acetone.
2. Sulfanilamide solution. 2 g sulfanilamide + 5 mL conc. H_3PO_4 diluted to 100 mL with distilled H_2O.
3. N-1-naphthylethylenediamine dihydrochloride (NEDA) solution. 70 mg NEDA dissolved in 50 mL distilled H_2O.
4. Combined reagent. 1 volume sulfanilamide solution + 1 volume water + 1/10 volume NEDA solution. Stable ca. one month if protected from light and refrigerated.
5. Sodium nitrite stock solution, 0.05 M. Dissolve 0.345 g (accurately weighed) $NaNO_2$ (reagent grade) in distilled water to make 100 mL solution. Protect from light and keep refrigerated. Stable 90 days.
6. Calibration stock solution. Dilute sodium nitrite stock solution with distilled water. Prepare fresh just before use. For example, a 1:50 dilution yields 1 nanomole NO_2^-/µL.

EQUIPMENT:

1. Sampler: See APPENDIX (potential sources of equipment given in reference [2]):
   a. Acrylic tubing, 3/8 inch (9.5 mm) ID.
   b. Stainless steel screen, 40 x 40 mesh/inch (16 x 16 mesh/cm).
   c. Polyethylene cap, 1/2 inch (12.7 mm, unflanged).
   d. Polyethylene cap, 1/2 inch (12.7 mm, flanged).
   e. Pen clips, 0.48 inch (12.2 mm) I.D.
   f. Electrical tape, plastic.
   g. Stopcock grease.
2. Spectrophotometer, reading at 540 nm, with 1-cm cuvettes.
3. Volumetric flasks and pipets for preparation of standards.
4. Mixer, vibration or vortex (optional).

SPECIAL PRECAUTIONS: None.

SAMPLING:

1. Attach the sampler with flanged cap down. Start sampling by removing flanged cap. Estimate appropriate sampling time such that the amount of NO_2 collected is in the range 1.2 to 80 ppm-hrs (0.13 to 8.5 µg NO_2).
2. Terminate sampling by replacing flanged cap.

CALIBRATION AND QUALITY CONTROL:

3. Calibrate daily.
   a. Prepare a series of working standards just before use over the range 0 to 40 nanomoles (0 to 1.84 µg) NO_2^- per 2.1 mL combined reagent.
   b. Allow 10 min for color development.
   c. Transfer an aliquot of the working standard to a cuvette and analyze (steps 6 through 8).
4. Plot absorbance at 540 nm against NO_2^- mass in nanomoles.
   NOTE: The absorbance of 40 nanomoles NO_2^- is ca. 1 absorbance unit.

5. Check dimensions of the sampler. If cross-sectional area divided by length (A_t/L) of the sampler tube differs significantly from 0.10 cm, recalculate the diffusive collection rate (step 9).

MEASUREMENT:

6. Remove flanged cap from samplers. Add 2.1 mL combined reagent directly into samplers.
   NOTE: If 2.1 mL is not sufficient to completely cover the exit slit of the spectrophotometer, a larger volume can be used provided the same volume is used for both standards and unknowns.
7. Recap the samplers and mix manually or with a mixer. Allow 10 min for the color to develop.
8. Transfer the solution to a cuvette and read the absorbance at 540 nm within 30 min from time reagent was added.
   NOTE: If sample reads beyond calibration graph, dilute sample with combined reagent or extend calibration range.

CALCULATIONS:

9. From calibration graph, read nanomoles NO_2 collected by the sampler. Divide by 2.3 nanomoles/ppm-hr (the diffusive collection rate [2]) and the sample exposure time, t (hr), to obtain time-weighted average concentration, C (ppm NO_2), of NO_2:

$$C = \frac{\text{nanomoles } NO_2}{2.3\ t}$$

   NOTE: Use 2.3•(actual A_t/L [cm] ÷ 0.1 cm) nanomoles/ppm-hr as the diffusive collection rate if sampler dimensions are different from those specified in the APPENDIX.

EVALUATION OF METHOD:

Analytical precision and useful range was estimated from a laboratory evaluation conducted by NIOSH (1982) [3]. Overall precision (s_r = 0.06) was estimated from side-by-side replicate samples collected in a underground salt mine [5]. In a laboratory study, this method gave results averaging 94 ± 4% (mean ± s_r) of a reference method over the range 1.3 to 79 ppm-hrs [3]. A field study found results for this method of 109 ± 9% (mean ± s_r) vs. a reference method in the range 12 to 19 ppm-hrs [5]. Sampling errors may exist in this method when the concentration is not constant in time and the sampling period is short [9,10]. For example, the value of s_r associated with estimating the TWA of an isolated random 10-sec concentration pulse within a 15-min sampling period may be calculated [9] to equal 0.5. Secondly, reference [9] reports a specific set of real-time concentration data measured in an industrial environment. For these data, the error s_r in making 15-min TWA estimates is calculated to equal 0.12. Although these values are large, similar sampling errors due to time variations are expected to be better controlled for longer sampling periods as the variance of the sampling error varies inversely with the sampling period.

REFERENCES:

[1] Criteria for a Recommended Standard...Occupational Exposure to Oxides of Nitrogen (Nitrogen Dioxide and Nitric Oxide), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 76-149 (1976).

[2] Palmes, E. D., A. F. Gunnison, J. DeMattio and C. Tomczyk. Personal Sampler for Nitrogen Dioxide, Am. Ind. Hyg. Assoc. J., 37, 570-577 (1976).

[3] Woebkenberg, M. L. A Comparison of Three Personal Passive Sampling Methods for NO_2, Am. Ind. Hyg. Assoc. J., 43, 553-561 (1982).

[1] Lindenboom R. and E. D. Palmes. Effect of Reduced Atmospheric Pressure on a Diffusional Barrier, Am. Ind. Hyg. Assoc. J., 44, 105-108 (1983).
[2] Jones W., E. D. Palmes, C. Tomczyk, and M. Millson. Field Comparison of Two Methods for the Determination of NO_2 Concentration in Air, Am. Ind. Hyg. Assoc. J., 40, 437-438 (1979).
[3] NIOSH Manual of Analytical Methods. 2nd. ed., V. 1, P&CAM 231, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-A (1977).
[7] Ibid, P&CAM 108.
[8] Ibid, V. 4, S320, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-175 (1978).
[9] Bartley, D. L., L. J. Doemeny and D. G. Taylor. Diffusive Monitoring of Fluctuating Concentrations, Am. Ind. Hyg. Assoc. J., 44, 241-247 (1983).
[10] Hearl, F. J. and M. P. Manning. Transient Response of Diffusive Dosimeters, Amer. Ind. Hyg. Assoc. J., 41, 778-783 (1980).

METHOD DEVELOPED BY: E. D. Palmes, New York University [2].

METHOD REVISED BY: William Jones and Frank Hearl, NIOSH/DRDS; Mary Lynn Woebkenberg, NIOSH/DPSE.

APPENDIX:

PREPARATION OF SAMPLER

1. Measure the average cross-sectional area of a length of 3/8 inch (9.5 mm) ID acrylic tubing.
   a. Cap one end of the tubing. Pour in a known volume, v (cm^3), of water to nearly fill the tubing (e.g., 100 mL water for a 180-cm (6-foot) length of tubing).
   b. Measure the height, h (cm), of the water column in the tubing.
   c. Determine the average cross-sectional area, A_t (cm^2), of the tubing.

$$A_t = \frac{v}{h}$$

2. Cut the tubing into lengths, L (ca. 7.1 cm), such that A_t/L = exactly 0.1 cm.
   NOTE: The collection rate is directly proportional to A_t/L. For A_t/L = 0.1 cm, the collection rate is 2.3 nanomoles/ppm-hr [2].
3. Cut circular portions, 13/32 inch (10.3 mm) to 7/16 inch (11.1 mm) in diameter, from stainless steel screen using a 13/32 inch (10.3 mm) paper punch or other suitable means.
4. Clean the tubes, screens and caps with detergent solution in an ultrasonic bath. Rinse with distilled water. Air dry.
5. Dip the screens in absorbing reagent.
6. Using forceps, place the screens on absorbent paper. Press the screens momentarily with the forceps tips to blot. Allow the acetone to evaporate.
7. Stack three treated screens in the bottom of an unflanged cap. Insert the acrylic tube into the unflanged cap securing the screens (see the figures).
8. Slide the pen clip onto the acrylic tube touching the unflanged cap. Secure the pen clip and unflanged cap with a piece of electrical tape.
9. Apply a small amount of stopcock grease to the outside of the uncapped end of the acrylic tube and slide the flanged cap into place.

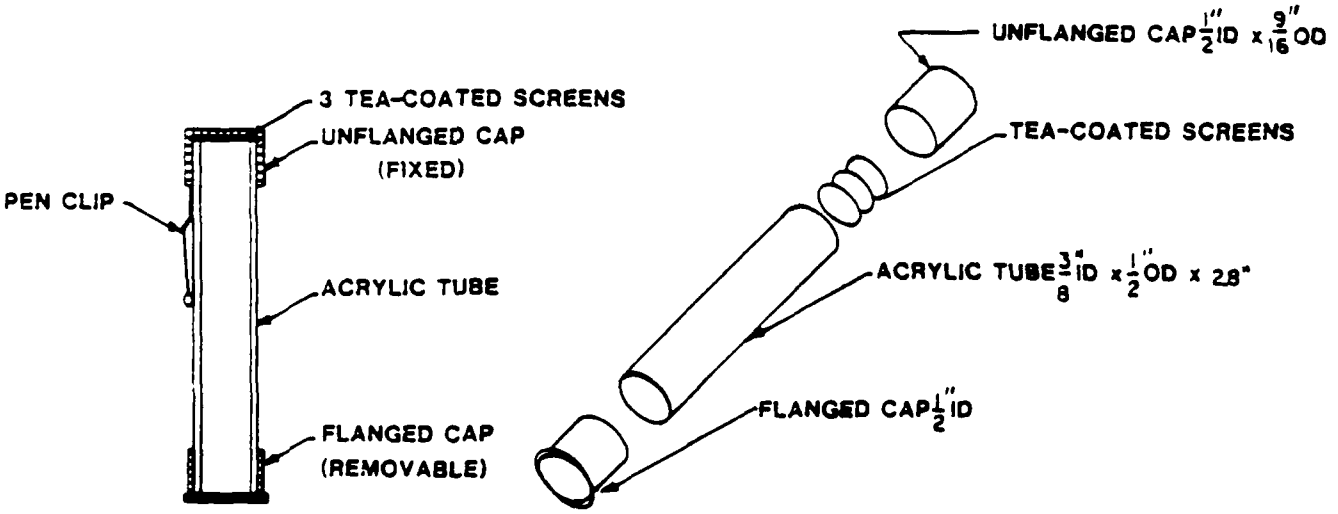


Figure 1. Assembled view (left) and exploded view (right) of sampler.

This page intentionally blank.

AMMONIA

Ammonia

Analyte:	Ammonia	Method No.: S347
Matrix:	Air	Range: 17-68 mg/cu m
OSHA Standard:	50 ppm (35 mg/cu m)	Precision ($\overline{CV}_T$): 0.062
Procedure:	Adsorption on sulfuric acid-treated silica gel, desorption with 0.1 N sulfuric acid, ammonia specific electrode	Validation Date: 11/25/77

1. Principle of the Method

   1.1 A known volume of air is drawn through a glass tube containing sulfuric acid-treated silica gel to trap ammonia vapors. The sampling tube is connected in series to a prefilter to collect particulate ammonium salts.

   1.2 Ammonia is desorbed from the silica gel with 0.1 N sulfuric acid, and the sample is analyzed using an ammonia specific electrode.

2. Range and Sensitivity

   2.1 This method was validated over the range of 16.9-67.6 mg/cu m at an atmospheric temperature of 24°C and atmospheric pressure of 759 mm Hg, using a 30-liter sample. This sample size is based on the capacity of the sulfuric acid-treated silica gel to collect vapors of ammonia in air at high relative humidity. The method is capable of measuring much smaller amounts if the desorption efficiency is adequate. Desorption efficiency must be determined over the range used.

   2.2 The upper limit of the range of the method is dependent on the adsorptive capacity of the sulfuric acid-treated silica gel. This capacity varies with the concentrations of ammonia and other substances in the air. Breakthrough is defined as the time that the effluent concentration from the collection tube (containing 200 mg of sulfuric acid-treated silica gel) reaches 5% of the concentration in the test gas mixture. Breakthrough was not observed after 310 minutes at an average sampling rate of 0.209 liter/minute and relative humidity of 85% and temperature of 25°C. The breakthrough test was conducted at an average concentration of 68.6 mg/cu m.

3. Interferences

3.1 When interfering compounds are known or suspected to be present in the air, such information, including their suspected identities, should be transmitted with the sample.

3.2 Methyl amine and ethyl amine are known interferences of the analytical method. Other volatile amines may also interfere in the analytical method.

3.3 Particulate contaminants such as ammonium salts are removed by the prefilter.

4. Precision and Accuracy

4.1 The Coefficient of Variation ($\overline{CV}_T$) for the total analytical and sampling method in the range of 16.9-67.6 mg/cu m is 0.062. This value corresponds to a 2.2 mg/cu m standard deviation at the OSHA standard level. Statistical information can be found in Reference 11.1. Details of the test procedures are found in Reference 11.2.

4.2 On the average, the concentrations obtained in the laboratory validation study at 0.5X, 1X, and 2X the OSHA standard level were 2.4% lower than the "true" concentrations for 18 samples. Any difference between the "found" and "true" concentrations may not represent a bias in the sampling and analytical method, but rather a random variation from the experimentally determined "true" concentration. The Coefficient of Variation is a good measure of the accuracy of the method since the recoveries and storage stability were good and would not contribute to a bias in a determined concentration. Storage stability studies on samples collected from a test atmosphere at a concentration of 33.8 mg/cu m indicate that collected samples are stable for at least 7 days.

5. Advantages and Disadvantages of the Method

5.1 The sampling device is small, portable, and involves no liquids. The tubes are analyzed by means of a quick, instrumental method.

5.2 One disadvantage of the method is that the amount of sample that can be taken is limited by the number of micrograms that the tube will hold before overloading. When the amount of ammonia found on the backup section of the sulfuric acid-treated silica gel tube exceeds 25% of that found on the front section, the probability of sample loss exists.

5.3 The precision of the method is limited by the reproducibility of the pressure drop across the tubes. This drop will affect the flow rate and cause the volume to be imprecise, because the pump is usually calibrated for one tube only.

6. Apparatus

6.1 Prefilter Unit: The prefilter unit, which is used to remove particulate interferences, consists of a 37-mm diameter cellulose ester membrane filter with a pore size of 0.80 micrometer contained in a 37-mm two-piece cassette filter holder. The filter is supported in the holder by a stainless steel screen.

6.2 Personal Sampling Pump: A calibrated personal sampling pump whose flow rate can be determined within 5% at the recommended flow rate.

6.3 Sulfuric Acid-Treated Silica Gel Sampling Tubes: Glass tube with both ends unsealed and fire-polished, 6.0-cm long with a 6-mm O.D. and a 4-mm I.D. containing two sections of 20/40 mesh sulfuric acid-treated silica gel (Section 8.2) separated by a 2-mm portion of glass wool. The adsorbing section of the tube contains 200 mg of sulfuric acid-treated silica gel and the backup section contains 100 mg. A plug of silylated glass wool is placed at the ends of the tube. The pressure drop across the tube must be no greater than 13 inches of water at a flow rate of 0.2 liter/minute. The glass tubes should be rinsed and dried with acetone before packing. The tubes are capped with plastic caps.

6.4 Orion Model 95-10 ammonia gas sensing electrode, or equivalent.

6.5 Orion Model 407 specific ion meter, or equivalent. A pH meter with a millivolt readout can also be used.

6.6 Scintillation vials, 20 mL.

6.7 Magnetic stirrer and stirring bars.

6.8 Pipets: Delivery type of convenient sizes.

6.9 Volumetric Flasks: 1-liter and 50-mL and other convenient sizes for preparing standard solutions.

6.10 Beakers, 250 mL.

6.11 Gas-tight syringes: 2- and 5-mL for preparing spiked samples.

6.12 Stopwatch.

6.13 Manometer.

7. Reagents

Whenever possible, reagents used must be ACS Reagent Grade or better.

7.1 Lecture bottle of ammonia gas, reagent grade.

7.2 Ammonium chloride, reagent grade.

7.3 Sulfuric acid, reagent grade in the following concentrations: 0.1 N and 0.4 N.

7.4 Prepare a 1000 micrograms/mL ammonia stock standard by weighing 3.1476 g ammonium chloride in a 1-liter volumetric flask. Make to volume with deionized water.

7.5 Prepare a 10,000 micrograms/mL ammonia stock standard by weighing 31.476 g ammonium chloride in a 1-liter volumetric flask. Make to volume with deionized water.

7.6 Sodium hydroxide solution, 10 N.

7.7 Silica gel, 20/40 mesh from SKC, Inc.

8. Procedure

8.1 Cleaning of Equipment. All glassware used for the laboratory analysis should be detergent washed, thoroughly rinsed with tap water and distilled water, and dried.

8.2 Preparation of Sulfuric Acid-Treated Silica Gel

8.2.1 Place 6 g of 20/40 mesh silica gel in a 250-mL beaker.

8.2.2 Add 15 mL of 0.4 N sulfuric acid to the beaker. Stir the mixture, and cover the beaker with a watch glass.

8.2.3 Heat the silica gel-acid mixture in a fume hood with a Bunsen burner to a very gentle boil. Evaporate approximately one-half of the liquid.

8.2.4 Place the covered beaker in a drying oven at 120°C until the remainder of the water has been evaporated.

8.2.5 The prepared acid-treated silica gel should flow freely and not adhere to the beaker. Store the silica gel in a desiccator until ready for use.

8.3 Calibration of Sampling Pumps. Each personal sampling pump must be calibrated with a representative sampling tube and prefilter cassette unit in the line to minimize errors associated with uncertainties in the volume sampled.

8.4 Collection and Shipping of Samples

8.4.1 Assemble the filter in the cassette holder and close firmly. The filter is backed up by a stainless steel screen rather than a filter pad. Secure the cassette holder with tape or shrinkable band.

8.4.2 Immediately before sampling, remove the caps from the ends of the sulfuric acid-treated silica gel tube. Remove the filter holder plugs and attach the outlet of the filter holder to the inlet of the sampling tube with a short piece of flexible tubing.

8.4.3 The smaller section of sulfuric acid-treated silica gel is used as a backup and should be positioned nearer the sampling pump.

8.4.4 The tube should be placed in a vertical direction during sampling to minimize channeling through the sulfuric acid-treated silica gel.

8.4.5 Air being sampled should not pass through any hose or tubing before entering the prefilter cassette.

8.4.6 A sample size of 30 liters is recommended. Sample at a flow rate between 0.1 and 0.2 liter/minute. Record the sampling time, flow rate, and type of sampling pump used.

8.4.7 The temperature, pressure, and relative humidity of the atmosphere being sampled should be recorded. If pressure reading is not available, record the elevation.

8.4.8 The sampling tube should be capped with plastic caps immediately after sampling. Under no circumstances should rubber caps be used.

8.4.9 The filter should be removed from the cassette filter holder and discarded. The cassette holders and stainless steel screens should be cleaned and saved for future use.

8.4.10 With each batch of ten samples, submit one tube from the same lot of tubes used for sample collection. This tube must be subjected to exactly the same handling as the samples except that no air is drawn through it. This tube should be labeled as the blank. A minimum of 18 extra sulfuric acid-treated silica gel tubes should be provided for desorption efficiency determinations.

8.4.11 Capped tubes should be packed tightly and padded before they are shipped to minimize tube breakage during shipping.

8.5 Analysis of Samples

The meter used in the analysis of samples must be calibrated before samples are analyzed. The procedure for calibration of the specific ion meter or pH/millivolt meter is discussed in Section 9. Proceed to Section 9 before sample analysis.

8.5.1 Preparation of Samples. Remove the plastic cap from the inlet end of the sampling tube. Remove the glass wool plug and transfer the first (larger) section of sulfuric acid-treated silica gel to a 20-mL scintillation vial. Remove the separating section of glass wool and transfer the backup section of sulfuric acid-treated silica gel to another scintillation vial. Analyze these two sections separately. Firm tapping of the tube may be necessary to effect complete transfer of the sulfuric acid-treated silica gel.

8.5.2 Desorption of Samples. Prior to analysis, 10 mL of 0.1 N sulfuric acid is pipetted into each vial. Cap and shake the sample vigorously. Desorption is complete in 45 minutes. Analyses should be completed within one day after the ammonia is desorbed.

8.5.3 Pipet an 8-mL aliquot of the desorbed sample into a clean 20-mL scintillation vial. Add 6 mL of deionized water to the vial.

8.5.4 Add 1 mL of 10 N sodium hydroxide to the vial to make the solution basic. The total volume in the vial should be 15 mL. Add a magnetic stirring bar. After addition of base, samples should be analyzed immediately.

8.5.5 Lower the ammonia specific electrode into the solution, taking care not to trap air under the electrode. If using a specific ion meter, record the meter reading on the logrithmic scale. This reading is the sample concentration in micrograms/mL. If a pH/millivolt meter is used, record the millivolt reading and refer to the calibration curve prepared in Section 9 to determine the sample concentration.

8.5.6 If the sample falls outside of the range of analysis, recalibrate the meter in the range of interest.

8.6 Determination of Desorption Efficiency

8.6.1 The desorption efficiency of a particular compound can vary from one laboratory to another. Thus, it is necessary to determine the fraction of the specific compound that is removed in the desorption process.

8.6.2 Extra sampling tubes containing sulfuric acid-treated silica gel are used to prepare spiked samples for desorption efficiency determinations. Spiked samples are prepared by drawing air through the tubes and spiking the air upstream of the tube with the appropriate amount of ammonia gas. Ammonia gas is spiked upstream using gas tight syringes. Volumes of 0.755, 1.51, and 3.02 mL of ammonia gas represent the amount present at 0.5X, 1X, and 2X the OSHA standard levels, respectively. The amount spiked is equivalent to that present in a 30-liter air sample at the selected level.

Six tubes at each of three levels (0.5X, 1X, and 2X the OSHA standard) are prepared in this manner and allowed to stand for at least overnight to ensure complete adsorption of the ammonia onto the sulfuric acid-treated silica gel. These tubes are referred to as the samples. A parallel blank tube should be treated in the same manner except that no sample is added to it. The sample and blank tubes are desorbed and analyzed in exactly the same manner as the sampling tube described in Section 8.5.

The desorption efficiency (D.E.) equals the average weight in micrograms recovered from the tube divided by the weight in micrograms added to the tube, or

$$D.E. = \frac{\text{Average Weight recovered (micrograms) - Blank}}{\text{Weight added (micrograms)}}$$

The desorption efficiency is dependent on the amount of ammonia collected on the sulfuric acid-treated silica gel. Plot the desorption efficiency versus weight of ammonia found. This curve is used in Section 10.5 to correct for adsorption losses.

9. Calibration and Standards

9.1 Prepare standard solutions containing 10 micrograms/mL, 100 micrograms/mL, and 1000 micrograms/mL as described below:

9.1.1 10 micrograms/mL: Using the 1000 micrograms/mL stock solution (Section 7.4), pipet a 5-mL aliquot into a 50-mL volumetric flask and bring to volume with deionized water. From this solution, pipet another 5-mL aliquot into a clean 50-mL volumetric flask, and add 20 mL 0.1 N sulfuric acid, 2 mL of 10 N sodium hydroxide, and bring to volume with deionized water. This final solution is the 10 micrograms/mL standard. Cap the solution after preparation.

9.1.2 100 micrograms/mL: Pipet a 5-mL aliquot from the 1000 micrograms/mL stock solution into a clean 50-mL volumetric flask. Add 20 mL 0.1 N sulfuric acid, 2 mL 10 N sodium hydroxide, and bring to volume with deionized water. Cap the solution after preparation.

9.1.3 1000 micrograms/mL: Pipet a 5-mL aliquot from the 10,000 micrograms/mL stock solution (Section 7.5) into a clean 50-mL volumetric flask. Add 20 mL 0.1 N sulfuric acid, 2 mL 10 N sodium hydroxide, and bring to volume with deionized water. Cap the solution after preparation.

Note: These standards are good for approximately 2 hours if kept tightly capped.

Additional standards may be prepared in order to accommodate the range of samples to be analyzed. Prepare additional standards over the range of interest using the 1000 micrograms/mL stock standard solution.

9.2 The specific ion meter must be calibrated over the range of interest using standard solutions prepared as described above. The meter is calibrated over a 10-fold concentration range.

To calibrate the specific ion meter in the range of 10-100 micrograms/mL, use the following procedure:

9.2.1 Place the electrode in the 10 micrograms/mL standard. Turn the function switch to X^- and adjust the meter needle to "10" on the logrithmic scale with the calibration control. Use magnetic stirring throughout the procedure.

9.2.2 Rinse the electrode and place in the 100 micrograms/mL standard and stir thoroughly. Turn the temperature compensator knob until the meter needle reads "100" on the logrithmic scale. The meter is now calibrated in the range of 10-100 micrograms/mL.

9.2.3 Recalibration of the meter is necessary in order to analyze samples outside of this range. Repeat the calibration procedure for the range of 100-1000 micrograms/mL.

9.3 If a pH/millivolt meter is used, the standards described above can be used to prepare a standard calibration curve. The curve is prepared on semi-log paper by plotting millivolt versus concentration in micrograms/mL. The concentration should be plotted on the logrithmic scale.

10. Calculations

10.1 Read the concentration, in micrograms/mL, corresponding to each meter reading.

10.2 Corrections for the blank must be made for each sample.

micrograms/mL = micrograms/mL sample - micrograms/mL blank

where:

micrograms/mL sample = micrograms/mL found in front section of sample tube

micrograms/mL blank = micrograms/mL found in front section of blank tube

A similar procedure is followed for the backup sections.

10.3 Determine the micrograms/sample by making the following volume correction.

$$\text{Micrograms/sample} = \text{micrograms/mL} \times 15 \text{ mL} \times \frac{10 \text{ mL}}{8 \text{ mL}}$$

10.4 Add the weights found in the front and backup sections to determine the total weight of the sample.

10.5 Read the desorption efficiency from the curve (see Section 8.6.2) for the amount found in the front section. Divide the total weight by this desorption efficiency to obtain the corrected micrograms/sample.

$$\text{Corrected micrograms/sample} = \frac{\text{Total weight}}{\text{D.E.}}$$

10.6 For personal sampling pumps with rotameters only, the following correction should be made.

$$\text{Corrected Volume} = f \times t\left(\sqrt{\frac{P_1}{P_2}} \times \frac{T_2}{T_1}\right)$$

where:

f = flow rate sampled

t = sampling time

P_1 = pressure during calibration of sampling pump (mm Hg)

P_2 = pressure of air sampled (mm Hg)

T_1 = temperature during calibration of sampling pump (°K)

T_2 = temperature of air sampled (°K)

10.7 The concentration of ammonia in the air sampled can be expressed in mg/cu m.

$$\text{mg/cu m} = \frac{\text{Corrected micrograms (Section 10.5)}}{\text{Corrected air volume (liters) (Section 10.6)}}$$

10.8 Another method of expressing concentration is ppm.

$$\text{ppm} = \text{mg/cu m} \times \frac{24.45}{\text{M.W.}} \times \frac{760}{P} \times \frac{T + 273}{298}$$

where:

P = pressure (mm Hg) of air sampled
T = temperature (°C) of air sampled
24.45 = molar volume (liter/mole) at 25°C and 760 mm Hg
M.W. = molecular weight of ammonia
760 = standard temperature (°K)
298 = standard temperature (°K)

11. References

11.1 Documentation of NIOSH Validation Tests, National Institute for Occupational Safety and Health, Cincinnati, Ohio (DHEW-NIOSH-Publication No. 77-185), 1977. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., Order No. 017-033-00231-2.

11.2 Backup Data Report for Ammonia, prepared under NIOSH Contract No. 210-76-0123.

This page intentionally blank.

SULFATES, SULFITES AND SULFUR DIOXIDE

SULFATES, SULFITES AND SULFUR DIOXIDE

Measurements Research Branch

Analytical Method

Analyte:	Sulfates, Sulfites and Sulfur Dioxide	Method No.:	P&CAM 268
Matrix:	Air	Range:	Sulfates: 0.1-10 mg/m^3 Sulfites: 0.1-10 mg/m^3 SO_2: 0.04-4 ppm (200-L air sample)
Procedure:	Particulate sulfates and sulfites collected on filter; SO_2 on treated filter; analysis by ion chromatography	Precision:	5% (Analytical)
Date Issued:	7/2/79		
Date Revised:		Classification:	E (Proposed)

1. Synopsis

A known volume of air is drawn through a filter train consisting of a cellulose ester membrane filter followed by an impregnated cellulose filter containing potassium hydroxide. Particulate matter, including sulfates and sulfites, is collected on the first filter, while sulfur dioxide passes through the first filter and is collected on the second filter.

The filters are extracted with deionized water and the extracts are analyzed by anion-exchange chromatography. The following quantities are obtained:

SO_2 concentration: calculated from the sulfite peak on the impregnated cellulose filter chromatogram.

Total sulfates concentration (sulfuric acid plus soluble metal sulfates): from the sulfate peak on the untreated cellulose ester membrane filter chromatogram.

Particulate sulfites concentration: from the sulfite peak on the untreated cellulose ester membrane filter chromatogram.

2. Working Range, Sensitivity, and Detection Limit

2.1 The working range for a 200-L air sample is 0.1-10 mg $SO_4^{=}$ or $SO_3^{=}/m^3$, and 0.04-4 ppm SO_2 (0.1-10 mg SO_2/m^3). This corresponds to 20-2000 µg of sulfate, sulfite or sulfur dioxide per sample.

2.2 The sensitivity at 30 µmho full scale is 5 µg sulfate, sulfite, or sulfur dioxide per sample per mm chart deflection. The sensitivity may be improved by using scale expansion on the readout and by using a smaller volume than 10 mL to desorb the sample.

2.3 The detection limit is approximately 0.5 µg $SO_4^{=}$ or $SO_3^{=}$/mL in the solution injected, corresponding to 5 g sulfate, sulfite, or sulfur dioxide per sample.

3. Interferences

3.1 Oxidation of particulate sulfite on the sample filters results in a positive bias for sulfates and a negative bias for particulate sulfites.

3.2 Sulfur trioxide gas, if present in dry atmospheres, gives a positive bias in the sulfur dioxide determination.

3.3 Nitrate or phosphate ions may give similar retention times to sulfite. Identity of the sulfite peak may be established by spiking the samples with known amounts of sulfite and analyzing with at least two different eluents (e.g., the eluent in Section 7.14 and 0.003 M $NaCO_3$/0.001 M $NaHCO_3$).

3.4 Insoluble sulfates collected on the first filter will not be measured unless special care is taken to dissolve them.

4. Precision and Accuracy

4.1 The relative standard deviation of the analytical method is 5% or less in the range 50-1000 µg $SO_3^{=}$ or $SO_4^{=}$ per sample, corresponding to 0.25-5 mg/m^3 SO_2, sulfites, or sulfates.

4.2 A major factor affecting accuracy is the tendency of particulate sulfites and absorbed sulfur dioxide to oxidize. Because of this, a negative bias which has not been thoroughly investigated occurs.

5. Advantages and Disadvantages

5.1 The sampling device uses only filters and involves no liquids.

5.2 Oxidation of a significant fraction of the particulate sulfites and sulfur dioxide in the sample is unavoidable.

5.3 Because identification is based on retention time, interferences may not be easily identified (see Section 3.3).

6. Apparatus

6.1 The apparatus for the collection of personal air samples consists of:

6.1.1 Filter holder, 3-piece cassette, polystyrene, 37-mm diameter.

6.1.2 Shrinkable cellulose band.

6.1.3 Mixed cellulose ester membrane filter, 0.8 micrometer pore size, 37-mm diameter, supported by a cellulose backup pad.

6.1.4 Cellulose filter, Whatman-40 or equivalent, impregnated with potassium hydroxide-glycerine solution, supported by a cellulose backup pad. To prepare the filter, saturate it with filter impregnating solution on a clean glass plate or watch glass and dry at 100°C for 20-30 minutes.

6.1.5 Personal sampling pump whose flow can be calibrated in line with a representative loaded filter holder to an accuracy of ±5% at the recommended flow rate.

6.1.6 Thermometer

6.1.7 Manometer

6.1.8 Stopwatch

6.1.9 Screw cap, glass bottles, such as scintillation vials.

6.1.10 Tweezers

6.2 Ion-exchange chromatograph, equipped with electrical conductivity detector and recorder or integrator.

6.3 10-mL pipette

6.4 10-mL plastic syringe with male Luer fitting

6.5 In-line filter with Luer fitting, 25 mm diam (0.8 μm membrane filter).

6.6 Volumetric flask, 100 mL

7. Reagents

All reagents used should be ACS Reagent Grade or better.

7.1 Deionized, filtered water. Conductivity-grade deionized water with a specific conductance of 10 μmho/cm or less is needed for preparation of eluents and other solutions which will be used on the ion chromatograph. The water should be filtered through a membrane filter (0.45-0.8 μm pore size) before use to avoid plugging valves on the chromatograph.

7.2 Potassium hydroxide, KOH (pellets)

7.3 Glycerol

7.4 Sodium carbonate, Na_2CO_3

7.5 Sodium bicarbonate, $NaHCO_3$

7.6 Sodium sulfite, Na_2SO_3

7.7 Sodium sulfate, Na_2SO_4

7.8 Nitrogen gas

7.9 Filter impregnating solution. Dissolve 20 g KOH in about 50 mL deionized water, add 10 mL glycerol and dilute with deionized water to 100 mL.

7.10 Sulfite stock standard (1000 ppm $SO_3^=$). Add 5 mL glycerol to a 100 mL volumetric flask and dissolve in approximately 75 mL deionized water which has been heated to 100°C and cooled under nitrogen to remove dissolved oxygen. Add 0.1575 g Na_2SO_3 and dilute to 100 mL with deionized water. This standard should be prepared fresh weekly.

7.11 Sulfite working standard (100 ppm $SO_3^=$). Pipette 10.0 mL of 1000 ppm sulfite stock standard into a 100 mL volumetric flask and dilute to 100 mL with a solution containing 2% (v/v) glycerol. Prepare fresh daily.

7.12 Sulfate stock standard (1000 ppm $SO_4^=$). Dissolve 1.4792 g Na_2SO_4 in deionized water and dilute to 1 liter.

7.13 Sulfate working standard (100 ppm $SO_4^=$). Dilute 10.0 mL of the sulfate stock standard to 100 mL with deionized water.

7.14 Eluent (0.003 M $CO_3^=$/0.003 M HCO_3^-). Dissolve 1.27 g Na_2CO_3 and 1.01 g $NaHCO_3$ in 4 liters of deionized, filtered water.

8. Procedure

8.1 Cleaning of Equipment. Glassware, including screw cap bottles, should be washed in detergent and rinsed in dilute (1-5%) nitric acid, followed by thorough rinsing with distilled or deionized water.

8.2 Collection and Shipping of Samples

8.2.1 Each personal sampling pump must be calibrated with a representative filter cassette in line to assure accurately known sample volumes.

8.2.2 Assemble the filter cassette as follows: First, place a backup pad in place in the rear section of the cassette. On top of this place a treated cellulose filter (Sec. 6.1.4) and then put the center retaining ring of the cassette in place. Next, put another backup pad on top of the retaining ring, place a mixed cellulose ester membrane filter (Sec. 6.1.3) on top of the backup pad, and put the front section of the cassette in place. A shrinkable band should be used to seal the cassette.

8.2.3 Collect the sample at 1.5 liters per minute. The air being sampled should not pass through any hose or tubing before entering the cassette. A sample size of 200 liters is recommended.

8.2.4 If significant amounts of sulfuric acid are suspected in the sample, the cellulose ester membrane filter must be transferred to a clean, glass bottle within 4 hours of sampling to avoid low recovery of sulfate. Handle the filter with tweezers to avoid contamination. Reclose the cassette containing the treated cellulose filter.

8.2.5 Carefully record the sample identity and all pertinent sampling data. With each batch of up to 10 samples submit appropriate blank filters for analysis.

8.3 Analysis of Samples

8.3.1 Put the two filters from the cassette into two separate, clean, screw-top glass bottles. Add 10.0 mL eluent (Sec. 7.14) to each bottle and let stand, with occasional vigorous shaking, for 30 minutes.

8.3.2 Pour the contents of the bottle into a syringe fitted with an in-line filter and collect the filtrate in a second syringe.

8.3.3 Inject the filtered sample onto the chromatograph and record the sample identity and instrumental conditions. Typical operating conditions are:

- sensitivity: 30 μmho full scale (for 5-100 ppm sulfate and sulfite)
- eluent: 0.0030 M Na_2CO_3, 0.0030 M $NaHCO_3$
- flow rate: 138 mL/hr
- separator column: 3 mm I.D. x 500 mm (anion exchanger), preceded by a precolumn
- suppressor column: 6 mm I.D. x 250 mm (cation exchanger)

- $SO_3^=$ retention time: 6-7.5 min (depending on eluent)

- $SO_4^=$ retention time: 9-10.5 min (depending on eluent)

8.3.4 Measure and record the peak height or peak area of each sulfite and sulfate peak. If interfering substances (e.g., nitrate or phosphate) are present, establish positive identity of sulfite and sulfate peaks by adding known amounts of standard solutions and by changing eluent concentration for better separation, if necessary.

9. Calibration and Standardization

9.1 From the 100 ppm working standards, prepare 5, 10, 15, 20, 30, 50, and 80 ppm sulfate and sulfite standards by diluting, respectively, 0.5, 1.0, 1.5, 2.0, 3.0, 5.0, and 8.0 mL to 10 mL with deionized water. These standard solutions should be prepared fresh daily.

9.2 With each set of samples analyzed, a complete calibration curve should be constructed, using the standards prepared in 9.1 or additional standards as needed. Plot peak height or peak area vs. concentration for both sulfite and sulfate. A sulfite standard with nominal concentration C_n (ppm) will give two peaks: a sulfite peak, C, and a sulfate peak, C_s (ppm). The relationship between these is $C = C_n - C_s \times 0.8334$.

10. Calculations

10.1 From the calibration curves obtained in Sec. 9.2, read the concentrations of sulfite and sulfate ions in each sample in ppm. Designate whether the ions originated on the cellulose ester membrane filter or the treated cellulose filter. Thus, four concentrations will be obtained.

C_1 = concentration, ppm, of sulfite from cellulose ester membrane filter

C_2 = concentration, ppm, of sulfate from cellulose ester membrane filter

C_3 = concentration, ppm, of sulfite from treated cellulose filter

C_4 = concentration, ppm, of sulfate from treated cellulose filter

10.2 Calculate the concentrations in the air sample using the formulae:

$$\text{Total particulate sulfite } (mg/m^3) = \frac{C_1 \times 10}{V}$$

$$\text{Total particulate sulfate } (mg/m^3) = \frac{C_2 \times 10}{V}$$

$$\text{Sulfur dioxide } (mg/m^3) = \frac{(C_3 \times 10 \times 0.08002) + (C_4 \times 10 \times 0.6669)}{V}$$

$$\text{Sulfur dioxide (ppm)} = 0.3817 \times \text{sulfur dioxide } (mg/m^3) \times \frac{760 \times T}{298 \times P}$$

where V is the volume (liters) of air sampled.

T is the absolute temperature ($^oK = {}^oC + 273$) at which the sample was taken.

P is the pressure (mm Hg) at which the sample was taken.

11. References

11.1 Mulik, J.D., R. Puckett, D. Williams, and E. Sawicki: Analysis of Nitrate and Sulfate in Ambient Aerosols. Anal. Lett. 9: 653(1976)

11.2 Pate, J.B., Lodge, and M.P. Neary: The Use of Impregnated Filters to Collect Traces of Gases in the Atmosphere. Anal. Chim. Acta 28: 341 (1963)

Peter M. Eller, Ph.D.
Michael Kraus
Inorganic Methods Development Section

This page intentionally blank.

TOTAL SUSPENDED PARTICULATES

DEFINITION: Total aerosol mass

NUISANCE DUST, TOTAL

METHOD: 0500
ISSUED: 2/15/84

OSHA: 15 mg/m^3
NIOSH: no standard
ACGIH: 10 mg/m^3, total dust less than 1% quartz

PROPERTIES: quartz less than 1% [1]

SYNONYMS: boron oxide (CAS #1303-86-2) and nuisance dusts [1] including alumina (CAS #1344-28-1), calcium carbonate (CAS #1317-65-3), cellulose (paper fiber; CAS #9004-34-6), glycerin mist (CAS #56-81-5), limestone (CAS #1317-65-3), etc.

SAMPLING	MEASUREMENT
SAMPLER: FILTER (tared 37-mm, 5-µm PVC filter)	TECHNIQUE: GRAVIMETRIC (FILTER WEIGHT)
FLOW RATE: 1.5 to 2 L/min	ANALYTE: airborne particulate material
VOL-MIN: 25 L @ 15 mg/m^3 -MAX: 133 L @ 15 mg/m^3	BALANCE: 0.01 mg sensitivity or better; use same balance before and after sample collection
SHIPMENT: routine	CALIBRATION: National Bureau of Standards Class M weights
SAMPLE STABILITY: indefinitely	RANGE: 0.3 to 2 mg per sample
BLANKS: 2 field blanks per 10 samples	ESTIMATED LOD: 0.2 mg per sample
BULK SAMPLE: none required	PRECISION: 0.08 mg per sample [3]
ACCURACY	
RANGE STUDIED: 8 to 28 mg/m^3	
BIAS: not significant	
OVERALL PRECISION (s_r): 0.056 [2]	

APPLICABILITY: The working range is 3 to 20 mg/m^3 for a 100-L air sample. This method is nonspecific and determines the total dust concentration to which a worker is exposed. It may be applied, e.g., to gravimetric determination of fibrous glass [4] in addition to the other ACGIH nuisance dusts [1].

INTERFERENCES: Organic and volatile particulate matter may be removed by dry ashing [4].

OTHER METHODS: This method is similar to the criteria document method for fibrous glass [4] and Method 5000 for carbon black. This method replaces Method S349 [5]. Impingers and direct-reading instruments may be used to collect total dust samples, but these have limitations for personal sampling.

EQUIPMENT:

1. Environmental chamber at constant temperature and humidity (e.g., 20 °C ± 0.3 °C and 50% ± 5% RH).
2. Sampler: 37-mm PVC, 2- to 5-μm pore size membrane or equivalent hydrophobic filter and cellulose supporting pad in 37-mm cassette filter holder.
3. Personal sampling pump, 1.5 to 2 L/min, with flexible connecting tubing.
4. Microbalance, capable of weighing to 0.01 mg.
5. Vacuum desiccator.
6. Static neutralizer: e.g., Po-210; replace nine months after the production date.

SPECIAL PRECAUTIONS: None.

PREPARATION OF FILTERS BEFORE SAMPLING:

1. Dry filters and backup pads under vacuum in the vacuum desiccator for at least 15 min.
2. Release the vacuum, remove the desiccator cover and equilibrate the filters in the environmental chamber for at least 1 hr.
3. Number the backup pads with a ballpoint pen and place them, numbered side down, in filter cassette bottom sections.
4. Weigh the filters in the environmental chamber. Record the filter tare weight, W_1 (mg).
   a. Zero the balance before each weighing.
   b. Handle the filter with forceps (nylon forceps if further analyses will be done).
   c. Pass the filter over an antistatic radiation source. Repeat this step if filter does not release easily from the forceps or if filter attracts balance pan. Static electricity can cause erroneous weight readings.
5. Place the weighed filters on top of the backup pads in the filter cassette bottom sections and allow to stand an additional 8 to 16 hrs in the environmental chamber.
6. Reweigh the filters. If this tare weight differs by more than 0.01 mg from the first tare weight obtained in step 4 above, discard the filter.
   NOTE: Insert a rod through the outlet hole of the filter cassette bottom section to raise the backup pad and filter so that the filter can be grasped with forceps.
7. Assemble the filter in the filter cassettes and close firmly so that leakage around the filter will not occur. Place a plug in each opening of the filter cassette. Place a cellulose shrink band around the filter cassette, allow to dry and mark with the same number as the backup pad.

SAMPLING:

8. Calibrate each personal sampling pump with a representative sampler in line.
9. Sample at 1.5 to 2 L/min. Do not exceed a total filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

10. Wipe dust from the external surface of the filter cassette with a moist paper towel to minimize contamination. Discard the paper towel.
11. Remove the top and bottom plugs from the filter cassette. Place the filter cassettes in a vacuum desiccator under vacuum for at least 15 min, followed by equilibration for at least 1 hr in the environmental chamber.
12. Remove the cassette band, pry open the cassette and remove the filter. Handle the filters very gently by the edge to avoid loss of dust.

NOTE: If the filter sticks to the underside of the cassette top, very gently lift away by using the dull side of a scalpel blade. This must be done carefully or the filter will tear.

CALIBRATION AND QUALITY CONTROL:

13. Zero the microbalance before all weighings. Use the same microbalance for weighing filters before and after sample collection. Maintain and calibrate the balance with National Bureau of Standards Class M weights.
14. Take two to four replicate samples for every batch of field samples for quality assurance on the sampling procedures. The set of replicate samples should be exposed to the same dust environment, either in a laboratory dust chamber [6] or in the field. The quality control samples must be taken with the same equipment, procedures and personnel used in the routine field samples. The relative standard deviation calculated from these replicates should be recorded on control charts and action taken when the precision is out of control.

MEASUREMENT:

15. Weigh each filter, including field blanks. Record this post-sampling weight, W_2 (mg), beside its corresponding tare weight. Record anything remarkable about a filter (e.g., overload, leakage, wet, torn, etc.).

CALCULATIONS:

16. Calculate the concentration of total nuisance dust, C (mg/m^3), in the air volume sampled, V (L):

$$C = \frac{(W_2 - W_1) + B}{V} \cdot 10^3, \ mg/m^3$$

where: W_1 = tare weight of filter before sampling (mg)
W_2 = post-sampling weight of sample-containing filter (mg)
B = mean change in field blank filter weights between tare and post-sampling (mg) (+ or -).

EVALUATION OF METHOD:

Lab testing with blank filters and generated atmospheres of carbon black was done at 8 to 28 mg/m^3 [2,6]. Precision and accuracy data are given on page 0500-1.

REFERENCES:

[1] TLVs - Threshold Limit Values for 1983-84, Appendix D, ACGIH, Cincinnati, OH (1983).
[2] This Manual, Method 5000.
[3] Unpublished data from Non-textile Cotton Study, NIOSH/DRDS/EIB.
[4] NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Fibrous Glass, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-152, 119-142 (1977).
[5] NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
[6] Documentation of the NIOSH Validation Tests, S262 and S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977).

METHOD WRITTEN BY: Kathy Morring, Jerry Clere, and Frank Hearl, P.E., NIOSH/DRDS.

This page intentionally blank.

RESPIRABLE SUSPENDED PARTICULATES

NUISANCE DUST, RESPIRABLE

METHOD: 0600
ISSUED: 2/15/84

FORMULA: The respirable fraction of the dust mass, as specified by the American Conference of Governmental Industrial Hygienists [1]

OSHA: 5 mg/m³
NIOSH: no standard
ACGIH: 5 mg/m³

PROPERTIES: Penetrates the non-ciliated portions of the lung; quartz less than 1%

SYNONYMS: boron oxide (CAS #1303-86-2) and nuisance dusts [2], including alumina (CAS #1344-28-1), calcium carbonate (CAS #1317-65-3), cellulose (paper fiber; CAS #9004-34-6), glycerin mist (CAS #56-81-5), limestone (CAS #1317-65-3), etc.

SAMPLING

SAMPLER: CYCLONE + FILTER
(10-mm Dorr-Oliver cyclone + tared 5-µm PVC membrane)

FLOW RATE: 1.7 L/min

VOL-MIN: 75 L @ 5 mg/m³
-MAX: 1000 L @ 5 mg/m³

SHIPMENT: routine

SAMPLE STABILITY: indefinitely

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: 0.5 to 10 mg/m³ (lab and field)

BIAS: depends on dust size distributions [3]

OVERALL PRECISION (s_r): 0.043 to 0.145 (lab); 0.144 to 0.227 (field) [4]

MEASUREMENT

TECHNIQUE: GRAVIMETRIC (FILTER WEIGHING)

ANALYTE: mass of respirable dust fraction

BALANCE: 0.01 mg sensitivity or better; use same balance before and after sample collection

CALIBRATION: National Bureau of Standards Class M weights

RANGE: 0.3 to 2 mg per sample

ESTIMATED LOD: 0.2 mg per sample

PRECISION: 68 µg with 0.01-mg sensitivity balance [5]

APPLICABILITY: The method measures the mass concentration of any non-volatile respirable dust. Besides inert dusts [1], the method is recommended for respirable coal dust, which has an OSHA PEL = 2.4 mg/m³. The method may be biased where the respirable fraction is defined by the British Medical Research Council's criteria or the MRE horizontal elutriator [4].

INTERFERENCES: Larger than respirable particles (over 10 µm) have been found in some cases by microscopic analysis of cyclone filters. Over-sized particles in the sample are known to be caused by inverting the cyclone assembly. Heavy dust loadings, charged particles, fibers and water-saturated dusts also interfere with the cyclone's size-selective properties.

OTHER METHODS: This method is based on and replaces Sampling Data Sheet #29.02 [6].

EQUIPMENT:

1. Sampler:
   a. Filter: 37-mm diameter, 5.0-μm pore size, polyvinyl chloride filter or equivalent hydrophobic membrane filter supported with backup pad in a two-piece, 37-mm cassette filter holder held together by tape or cellulose shrink band.
   b. Cyclone: 10-mm Dorr-Oliver nylon cyclone.
   c. Sampling head holder: this holder must keep the cassette, cyclone and coupler together rigidly so that air enters only at the cyclone inlet.
2. Personal sampling pump, 1.7 L/min ± 5%, with flexible connecting tubing.
   NOTE: Pulsation in the pump flow must be within ± 20% of the mean flow.
3. Balance, analytical, with sensitivity of at least 0.01 mg. A more sensitive balance will be necessary for substances with PEL's below 1 mg/m^3.
4. Static neutralizer, e.g., Po-210; replace nine months after the production date.
5. Environmental chamber for balance, e.g., 20 °C ± 0.3 °C and 50% ± 5% RH.
6. Vacuum desiccator.

SPECIAL PRECAUTIONS: None.

PREPARATION OF SAMPLERS BEFORE SAMPLING:

1. Dry filters and backup pads under vacuum in the vacuum desiccator for at least 15 min.
2. Release the vacuum, remove the desiccator cover, and equilibrate the filters in the environmental chamber for at least 1 hr.
3. Number the backup pads with a ballpoint pen and place them, numbered side down, in filter cassette bottom sections.
4. Weigh the filters in the environmental chamber. Record the filter tare weight, W_1 (mg).
   a. Zero the balance before each weighing;
   b Handle the filter with forceps (nylon forceps if further analyses will be done); and
   c. Pass the filter over an antistatic radiation source. Repeat this step if filter does not release easily from the forceps or if filter attracts balance pan. Static electricity can cause erroneous weight readings.
5. Place the weighed filters on top of the backup pads in the filter cassette bottom sections and allow to stand an additional 8 to 16 hrs in the environmental chamber.
6. Reweigh the filters. If this tare weight differs by more than 0.01 mg from the first tare weight obtained in step 4 above, discard the filter.
   NOTE: Insert a rod through the outlet hole of the filter cassette bottom section to raise the backup pad and filter so that the filter can be grasped with forceps.
7. Assemble the filters in the filter cassettes and close firmly so that leakage around the filter will not occur. Place a plug in each opening of the filter cassette. Place a cellulose shrink band around the filter cassette, allow to dry, and mark with the same number as the backup pad.
8. Remove the cyclone's grit cap and vortex finder before use and inspect the cyclone interior. If the inside is visibly scored, discard this cyclone since the dust separation characteristics of the cyclone might be altered. Clean the interior of the cyclone to prevent reentrainment of large particles.
9. Assemble the sampler head. Check alignment of filter holder and cyclone in the sampling head to prevent leakage.

SAMPLING:

10. Calibrate each personal sampling pump to 1.7 L/min with a representative sampler in line.
11. Sample at 1.7 L/min for 45 min to 8 hrs (76 to 816 L). Do not exceed 5 mg dust loading on the filter.

    NOTE: Do not allow the sampler assembly to be inverted at any time. Turning the cyclone to anything more than a horizontal orientation may deposit over-sized material from the cyclone body onto the filter.

SAMPLE PREPARATION:

12. Wipe dust from the external surface of the filter cassette with a moist paper towel to minimize contamination. Discard the paper towel.
13. Remove the top and bottom plugs from the filter cassette. Place the filter cassettes in a vacuum desiccator under vacuum for at least 15 min, followed by equilibration for at least 1 hr in the environmental chamber.
14. Remove the filter cassette band, pry open the filter cassette, and remove the filter by inserting a rod in the outlet hole of the filter cassette. Handle the filters very gently by the edge to avoid loss of dust.

    NOTE: If the filter sticks to the underside of the cassette top, very gently lift away by using the dull side of a scalpel blade. This must be done carefully or the filter will tear.

CALIBRATION AND QUALITY CONTROL:

15. Zero the microbalance before all weighings. Use the same microbalance for weighing filters before and after sample collection. Calibrate the balance with National Bureau of Standards Class M weights.
16. Take two to four replicate samples for every batch of field samples for quality assurance on the sampling procedures. The set of replicate samples should be exposed to the same dust environment, either in a laboratory dust chamber [7] or in the field [8]. The quality control samples must be taken with the same equipment, procedures and personnel used in the routine field samples. Calculate precision from these replicates and record s_r on control charts. Take corrective action when the precision is out of control [7].

MEASUREMENT:

17. Weigh each filter, including field blanks. Record this post-sampling weight, W_2 (mg), beside its corresponding tare weight. Record anything remarkable about a filter (e.g., visible particles, overloaded, leakage, wet, torn, etc.).

CALCULATIONS:

18. Calculate the concentration of respirable nuisance dust, C (mg/m^3), in the air volume sampled, V (L):

$$C = \frac{(W_2 - W_1) + B}{V} \cdot 10^3, \ mg/m^3$$

where: W_1 = tare weight of filter before sampling (mg)
W_2 = post-sampling weight of sample-containing filter (mg)
B = mean change in field blank filter weights between tare and post-sampling (mg) (+ or -).

EVALUATION OF METHOD:

1. Bias. In respirable dust measurements, the bias in a sample is calculated relative to the appropriate respirable dust criterion. The theory for calculating bias is developed by Bartley and Breuer [3]. For this method, the bias, therefore, depends on the ACGIH criterion for respirable dust, the cyclone's penetration curve at 1.7 L/min flow rate, and the size distribution of the ambient dust. Based on the cyclone's penetration curves for non-pulsating flow measured with a monodisperse aerosol by Caplan, Doemeny and Sorenson [9], the bias in this method is shown in Figure 1.

   For dust size distributions in the shaded region, the bias in this method lies within the $\pm$ 0.10 criterion established by NIOSH for method validation. Bias larger than $\pm$ 0.10 would, therefore, be expected for many workplace aerosols, especially those with small mass median diameters. However, bias within $\pm$ 0.20 would be expected for dusts with geometric standard deviations greater than 2.0, which is the case in most workplaces.

   Bias can also be caused in a cyclone by the pulsation of the personal sampling pump. Bartley, et al. [10] showed that cyclone samples with pulsating flow can have negative bias as large as -0.22 relative to samples with steady flow. The magnitude of the bias depends on the amplitude of the pulsation at the cyclone aperture and the dust size distribution. For pumps with instantaneous flow rates within 20% of the mean, the pulsation bias is less than -0.02 for most dust size distributions encountered in the workplace.

   Electric charges on the dust and the cyclone will also cause bias. Briant and Moss [11] have found electrostatic biases as large as -50%, and show that cyclones made with graphite-filled nylon eliminate the problem.

2. Precision. In a recent review [4], the overall cyclone precision is shown to be most sensitive to two factors: the analytical precision and the sampling procedures, particularly the quality control system used in the maintenance and calibration of samplers. Theoretically, the variance for the overall precision is the sum of the variances from the sampling and analysis. The analytical variance depends on the dust loading on the filter. For the dust loading in an 8-hr sample above 1.5 mg/m^3, Bowman, et al. [4] find that the empirically determined sampling error dominates this analytical error.

   Because of the effects of the environment, precision estimates for dust samplers are much more variable than those reported for gas and vapor sampling. In laboratory tests with 0.01 mg sensitivity balances, the overall precision of a single respirable dust sample has relative standard deviations (s_r) from 0.043 to 0.145 over concentrations ranging from 0.5 to 5 mg/m^3. In the laboratory studies where the dust concentrations in the test chamber are more carefully controlled, the estimated s_r is less than 0.091, which is the target precision value for a bias equal to $\pm$ 0.10 in the NIOSH validation criteria.

   In the field tests with 0.01 mg sensitivity balances, precision estimates range from 0.144 to 0.227 over concentrations ranging from 1 to 10 mg/m^3. Whether the larger s_r values in field tests are due to sampler performance or to more inhomogeneous dust concentrations in the field tests cannot be determined from existing data.

REFERENCES:

[1] TLVs - Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment with Intended Changes for 1983-84, 38, ACGIH, Cincinnati, OH (1983).

[2] Ibid, Appendix D, 52.

[3] Bartley, D. L. and G. M. Breuer. Analysis and Optimization of the Performance of the 10-mm Cyclone, Am. Ind. Hyg. Assoc. J., 43, 520-528 (1982).

[4] Bowman, J. D., D. L. Bartley, G. M. Breuer and S. A. Shulman. The Accuracy of Sampling Respirable Coal Mine Dust, Draft NIOSH report (1983).

[5] Parobeck, P., T. F. Tomb, H. Ku and J. Cameron. Measurement Assurance Program for the Weighings of Respirable Coal Mine Dust Samples, J. Qual. Tech., 13, 157 (1981).

[6] NIOSH Manual of Sampling Data Sheets, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-159 (1977).

[7] Bowman, J. D., D. L. Bartley, G. M. Breuer, L. J. Doemeny and D. J. Murdock. Accuracy Criteria Recommended for the Certification of Gravimetric Coal Mine Dust Personal Samplers, NIOSH report (in press, 1983).

[8] Breslin, J. A., S. J. Page and R. A. Jankowski. Precision of Personal Sampling of Respirable Dust in Coal Mines, U.S. Bureau of Mines Report of Investigations #8740 (1983).

[9] Caplan, K. J., L. J. Doemeny and S. Sorenson. Evaluation of Coal Mine Dust Personal Sampler Performance, Final Report, NIOSH Contract No. PH CPE-r-70-0036 (1973).

[10] Bartley, D. L., G. M. Breuer, P. A. Baron and J. D. Bowman. Pump Fluctuations and Their Effect on Cyclone Performance, submitted to the Am. Ind. Hyg. Assoc. J. (1983).

[11] Briant, J. K. and O. R. Moss. The Influence of Electrostatic Charge on the Performance of 10-mm Nylon Cyclones, American Industrial Hygiene Conference (1983).

METHOD WRITTEN BY: Joseph Bowman, Ph.D., CIH, NIOSH/DPSE.

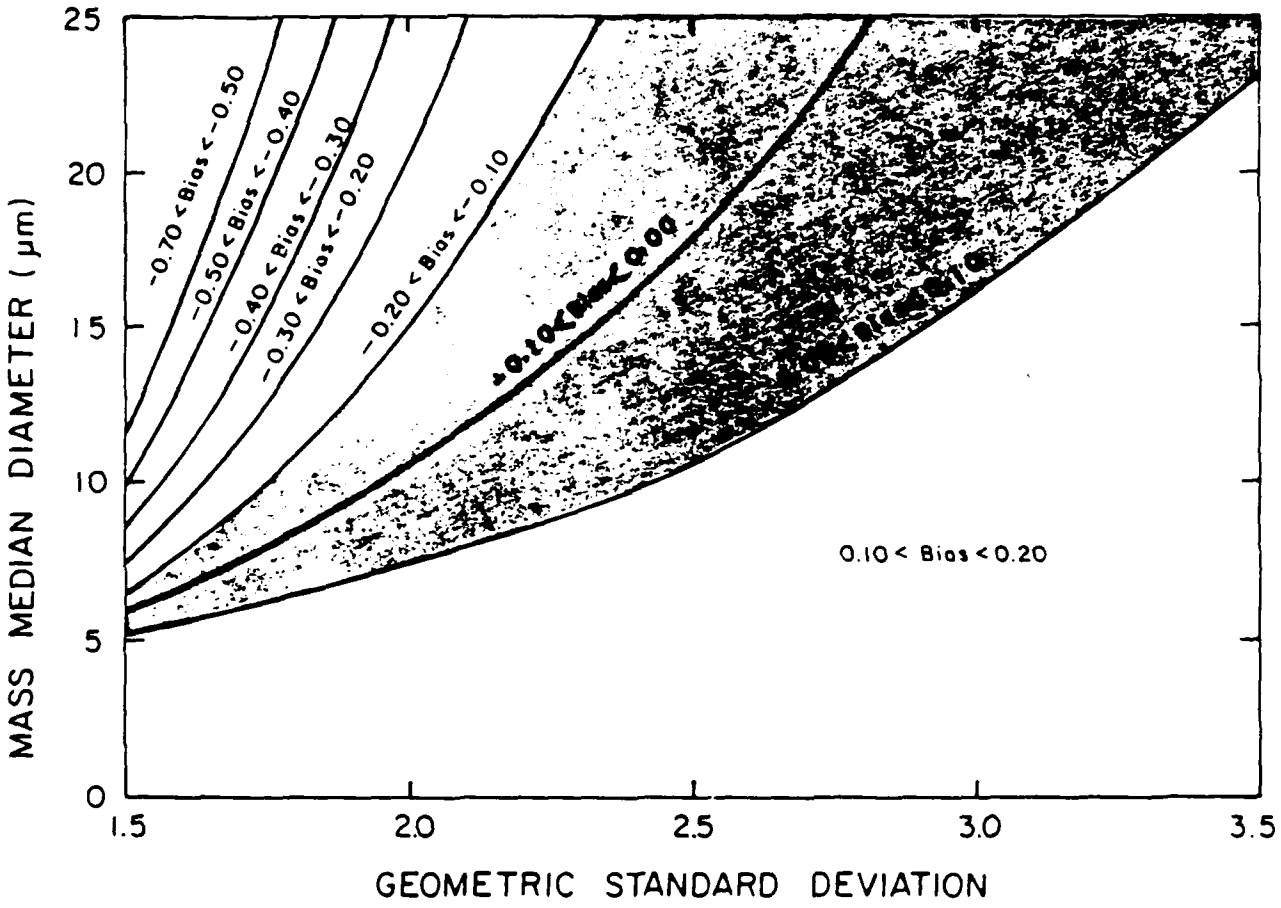


Figure 1. Bias in respirable dust determination.

2/15/84

NITRO-POLYCYCLIC AROMATIC HYDROCARBONS

ANALYTICAL PROCEDURES FOR NITRO-PAHs IN DIESEL PARTICULATE EXTRACTS

- Analytes:

  2-Nitrofluorene
  3-Nitro-9-fluorenone
  9-Nitroanthracene
  3-Nitrofluoranthene
  1-Nitropyrene
  2,7-Dinitrofluorene
  1,8-Dinitropyrene
  6-Nitrobenzo(a)pyrene

- Summary:

  Diesel particulate extracts in methylene chloride are separated into aliphatic and aromatic fractions using HPLC/UV. The aromatic fraction is analyzed for nitro-PAHs using GC/ECD.

- Sample Preparation:

  1. Dissolve the diesel extract in methylene chloride (to 5 mg/mL).

  2. Dilute 100 uL of the 5 mg/mL sample to 0.5 mL with 1% MeOH in C_6.

  3. Inject 200 uL of a nitro-PAH standard into HPLC system. HPLC conditions are as follows:

     Column: uBondapak NH_2
     7.8 mm x 30 cm

     Mobile Phase: 10/90 CH_2Cl_2-C_6
     1.5 mL/min

     UV Detector: \254, x0.2 AUFS

  4. The results from the standard chromatogram determine where to fraction the diesel extracts. The nitro-PAHs typically elute between 12.5 and 18.75 minutes.

5. Fraction a 200-uL aliquot of the MeOH/C_6 diesel sample. Collect only the 12.5-18.75 min fraction for analysis. The fractionation is done with the UV lamp off and is based on retention time. Keep the room as dark as possible.

6. Concentrate the sample to 0.5 mL in hexane using N_2 and a hot water bath. Add 1 uL of lindane (0.75 ng/uL) as an internal standard.

- Sample Analysis:

1. Inject 1 uL of the extract onto the GC. Chromatographic conditions are as follows:

Column:	DB-5 30 m x 0.32 mm fused-silica capillary column
Carrier Gas:	Helium, 2 mL/min
Makeup Gas:	Nitrogen, 8-9 mL/min
Column Temp.:	40°C (1 min) 15°C/min → 150°C 5°C/min → 300°C (5 min)
Injector Temp.:	250°C
ECD Temp.:	315°C

2. Calibration standards containing 5-150 ppb of each analyte should be analyzed with the samples.

HYDROGEN CYANIDE

A personal sampling apparatus for firefighters was developed to sample the fire atmosphere for CO, CO_2, O_2, NO_2, HCl, HCN and particulate content. Two fire companies made ninety successful sample runs during structural fires. CO presented a potential acute hazard and particulate concentrations were high. HCN was detected at low levels in half the samples. HCl was detected in only eight samples but on two occasions exceeded 100 ppm. CO and NO_2 levels and O_2 depression do not appear to represent significant hazards.

Exposure of firefighters to toxic air contaminants

AVRAM GOLD, WM. A. BURGESS and EDWARD V. CLOUGHERTY*
Kresge Center for Environmental Health, Harvard School of Public Health, Boston, MA
*Boston Fire Department, Boston, MA

Introduction

Despite considerable laboratory work and test data, little field data on the exposure of firefighters to toxic combustion gases are available.[1-3] In addition to acute hazards, significant long range health effects are implicated in firefighting. One study[4] has determined that pulmonary function as measured by FVC and $FEV_{1.0}$ decreases twice as fast among firefighters as among the general population. The same study demonstrated correlation between frequency and estimated severity of exposure and accelerated loss of lung function among individual firefighters. Other work[5] has identified heart disease as a special problem of firefighters, possibly arising from extensive stress including exposure to high levels of CO. These and other studies which implicate inhalation of combustion products as a significant factor in morbidity and mortality among firefighters point up the urgency of examining quantitatively the atmosphere to which firefighters are exposed on the job. This paper describes the development and use of personal sampling as a means for evaluating airborne contaminants encountered during structural firefighting operations by two units of the Boston Fire Department.

Six gases, O_2, CO_2, CO, NO_2, HCl and HCN were monitored in this study. In addition, provision was later made to collect and measure total particulates. Oxygen was selected in order to determine whether depressed O_2 levels often reported in experimental burns are a hazard in real fire situations. Previous field work in which CO and O_2 were monitored at real fires has not shown this to be the case.[1] Carbon monoxide, a product of incomplete combustion of carbonaceous materials was selected for monitoring because it is ubiquitous at fires and is currently considered to represent the most dangerous acute exposure faced by firefighters.[1-3] Carbon dioxide, the end product of complete combustion of carbon containing materials, has been reported in high concentration in experimental burns[3] and was selected for study since it is considered by some workers to represent a major hazard. Nitrogen dioxide is a highly toxic gas whose presence at fires might be expected through fixation of atmospheric nitrogen[3,6] and, to a lesser extent from the oxidation of nitrogenous materials. The extreme toxicity of nitrogen dioxide and the fact that firefighters have at times suffered symptoms consistent with exposure to this gas, lead to its inclusion in the study. Hydrochloric acid could arise from the pyrolysis and combustion of PVC-containing plastics frequently encountered in structural fires.[7] Sources of hydrogen cyanide are wool and plastics containing urethanes, acrylonitriles or polyamides.[3,8] Because of the abundance of plastics in home furnishings, vehicles, and aircraft, HCl and HCN could be significant hazards to firefighters, and were therefore also monitored.

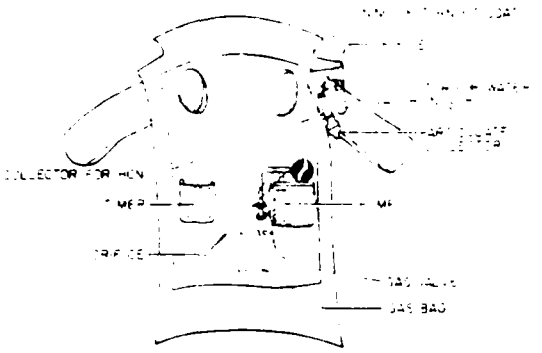


Figure 1 – Turnout coat equipped with sampling system

sampling system

During operations, Boston firefighters wear protective equipment weighing approximately sixty pounds. Any air sampling equipment must be compatible with this gear. To withstand severe mechanical stress during firefighting the sampler must be rugged and for safety reasons must in no way restrict the firefighter's movement. Since speed is of the utmost importance in firefighting, activation and shutdown of the system must be conveniently accomplished.

The sampling system is shown in Figure 1. All tubing in the system is polyethylene and all connections made with Swage Lok fittings. Tubing and wiring are concealed between the coat and liner and fastened to the liner at critical points. The external reagent tubes are secured below the collar by a fastener riveted to the coat and may be conveniently removed and exchanged by loosening the Swage Lok fittings. A 25 mm filter holder is fastened to one reagent tube by a rubber connector. A 2.5 L PVC grab sampling bag is suspended between the coat and liner. Upon completion of the sample run, the firefighter closes a 1/4 - turn valve to retain the bag sample.

Orifices fashioned from 6 mm lengths of 23 ga. syringe needle soldered into the tees regulate the flow at approximately 0.3 L/min in all branches of the sampler. If the sampling period extends beyond the bag filling time (9 minutes) the flow through the reagent tubes decreases to 0.23 L/min, while the overflow sample is dumped through the open ended branch of the tee downstream from the pump.

The pump is an MSA Model G modified by removal of the flow control and rotameter and placement of the switch in the rotameter recess. This placement allows easy operation of the pump while guarding against inadvertant operation of the switch. A timer is wired into the switch and records time directly in minutes.

The firefighters participating in the study were instructed in the design and use of the coat. They were asked to activate the pump at the immediate location of the fire and to shut down the sampler upon leaving the location. The firefighters filled out a questionnaire after each test. Two companies, Aerial Tower 2 and Engine 43, participated in the study; each made 45 sample runs.

analytical methods

Nitrogen dioxide. The analysis is based on a modified Saltzmann method[13,14] in which the NO_2 is trapped on 13X molecular sieves impregnated with triethanolamine (TEA). The sieves are contained in one of the reagent tubes, downstream from activated 13X sieves which serve to prevent condensation of water in the sample line (Figure 2 A). For the analysis, the sieves are thoroughly mixed and half are used for the NO_2 determination. The sieves are desorbed with 12 ml of a 0.1 M solution of TEA.[15] A 5 ml aliquot is removed for color development, with a final volume made up to 21 ml. For a 1000 ml gas sample, the detection limit is approximately 0.5 ppm.

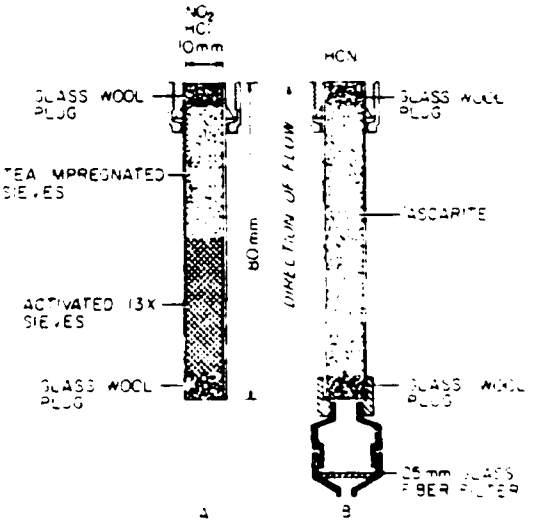


Figure 2 – Reagent tubes and filter for total particulates

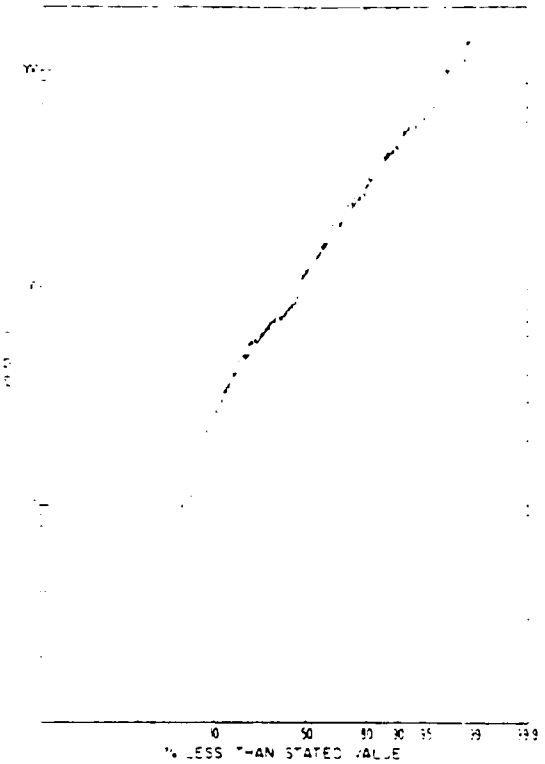


Figure 3 - Distribution of CO concentrations. Geometric mean 1.10 ppm, geometric standard deviation 3.0

Hydrogen chloride. The TEA impregnated sieves are an efficient trap for HCl and the remaining sieves are used for this determination. The mercuric thiocyanate method [4] for chloride ion is employed. The sample is desorbed with 10 ml deionized water and a 5 ml aliquot removed for analysis. Final volume of the developed aliquot is 25 ml. Under these conditions the limit of detection is 20 ppm in a 1000 ml gas sample. TEA, acetic and formic acids, acetaldehyde and formaldehyde do not affect color development. More sensitive chloride determinations [4,5] could not be adapted to the method of sample collection or to the batch type analytical operation required by the study.

Hydrogen cyanide. Hydrogen cyanide is collected on 30-60 mesh Ascarite in the second reagent tube (Figure 2 B) and determined colorimetrically by conversion to cyanogen chloride and oxidation of pyridine by cyanogen chloride to a dialdehyde which forms a chromophore with barbituric acid. [6] The Ascarite from the tube is dissolved in 25 ml distilled water, the solution filtered and a 10 ml aliquot of filtrate titrated with 4 N HCl to a phenolphthalein end point. The neutralized solution is treated with the colorimetric reagents and made up to a final volume of 25 ml. Sensitivity for a 1000 ml gas sample is approximately 0.09 ppm.

Carbon monoxide, oxygen and carbon dioxide. These three gases are determined in the bag sample at the fire station. CO is determined with an Ecolyzer Model 2400, O_2 is determined by a Beckman Model D paramagnetic oxygen analyzer and CO_2 by Bendix 2L CO_2 detector tubes.

Particulates. Particulates are collected on pretared 25 mm binderless glass fiber filters and determined gravimetrically. The filter cassette is attached to the Ascarite reagent tube (Figure 2 B).

discussion

CO, HCN, and particulate concentrations plotted in log-probability coordinates are

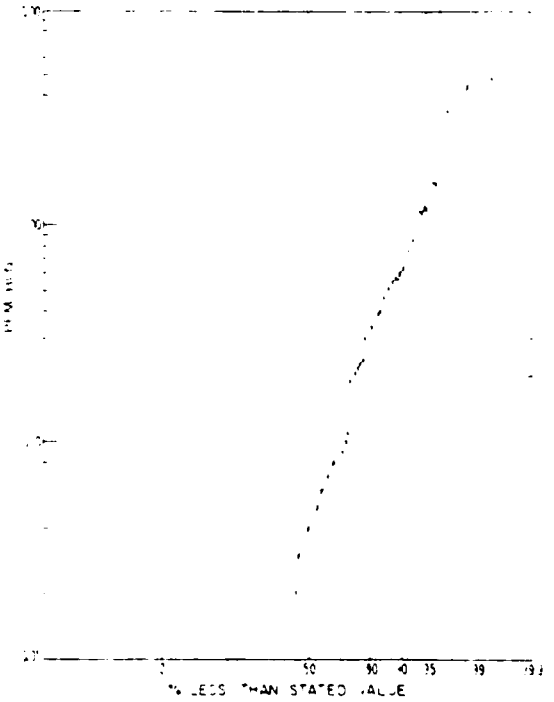


Figure 4 - Distribution of HCN concentrations. Geometric mean 0.04 ppm, geometric standard deviation 8.3

presented in Figures 3-5 with the best straight lines visually fitted to the data. The distributions appear to be lognormal, in conformance with much air sampling data.[19] Data on O_2, CO_2, HCl, and NO_2 are summarized in Table I.

Sampling times were bimodally distributed around 7 and 9 minutes. CO was uniformly present at all fires at elevated levels. The highest concentrations were recorded at fires where there was general involvement of structures, furniture and trash and were not correlated with any specific materials. The median value for the CO samples was 110 ppm, with 3% exceeding 1000 ppm.

Particulates were also present in significant amounts, with a median concentration of 22 mg. m^{-3} and 15% of the samples being in excess of 100 mg m^{-3}. The highest particulate exposures occurred at fires involving the highest CO exposures.

Hydrogen cyanide was detected frequently, though at low levels. Of the 43 samples in which cyanide was detected, eleven were from fires that were confined to a few specific materials: one upholstered chair, five mattress, two tire and two vehicle fires and one fire involving butyl rubber and silicone rubber insulated wire in a curing oven. Of six incidents in which the HCN concentrations were over 1 ppm, three were mattress fires and one a vehicle fire.

Hydrogen chloride was detected in five fires. In all five cases there was general involvement of a room, its contents and an assortment of rubbish. In two of the incidents "plastics" were specifically identified among the combustibles by firefighters. The maximum concentration recorded was 150 ppm.

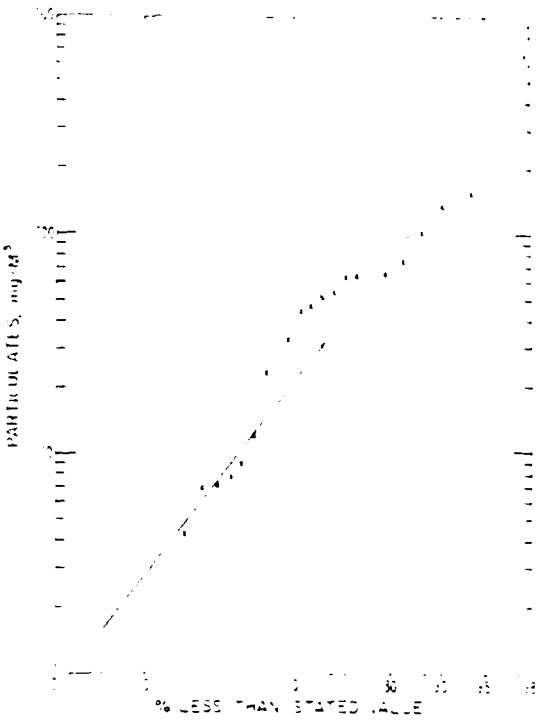


Figure 5 - Distribution of particulate concentrations. Geometric mean 21.5 mg. m geometric standard deviation, 4.7

Carbon dioxide concentrations never exceeded the lowest detectable limit of the

TABLE I

Summary of Data on O , CO , HCl and NO

Gas	No samples taken	No samples in which detected	Comments
O	79	79	Depressed 0.5% in 7 samples 0.4% 4 0.3% 3 0.2% 12 0.1% 9
CO	63		Never with certainty above 0.26%
HCl	30	5	Concentration (ppm): 18 32 75 128 150*
NO	80	8	Concentration (ppm): 0.02 0.29 0.31 0.37 0.59* 0.63 0.64 0.89

*Results questionable because of short sampling time

detector (0.26 ppm), and oxygen levels below 20% were not recorded for any fire.

Nitrogen dioxide was detected on eight occasions, with 0.89 ppm being the highest concentration observed.

The data indicate that carbon monoxide is the one gas of those monitored that could involve a potential acute hazard for the firefighters of Aerial Tower 2 and Engine 43. Particulates may occur in high enough concentrations to have significant long term health effects. Although hydrogen cyanide was frequently detected, concentrations did not pose an acute hazard based on the Short Term Exposure Limit of 15 ppm.

The fire companies participating in this study are located in older, delapidated residential sections of Boston. Structures are for the most part old and apt to contain fewer synthetic materials than those more recently constructed. Many structural fires appear to be the work of arsonists and include materials such as tires, gasoline and trash. The exposures experienced by firefighters in this study might therefore differ from those in newer residential or industrial areas. Hence, more widespread sampling is necessary to establish the general applicability of these results.

The data on CO and HCN concentrations collected by each of the companies were compared and found not to differ significantly at the 99% level of confidence.

On the basis of results to date, plans are to revise the sampling program to include monitoring of organic vapors, particularly aldehydes and acids.

acknowledgements

This report was supported in part by NIOSH Grant No. OH-003-69-04. The authors wish to express their appreciation to Commissioner Paul and Chief Buchanan of the Boston Fire Department, the International Association of Fire Fighters Local 718 for their cooperation, and to the individual firefighters who assisted in this study. Special thanks are due Peter Provost who conducted much of the field work.

references

1 **Burgess, W. A., R. Sidor, J. J. Lynch, P. Buchanan and E. V. Clougherty**: Minimum Protection Factors for Respiratory Protective Devices. *Am. Ind. Hyg. Assoc. J. 38*: 18 (1977).

2 **Anon**: Answers to Burning Questions. *Mosaic 4*(2): 3 (1973).

3 **Peters, J. M., G. P. Theriault, L. J. Fine and D. H. Wegman**: Chronic Effects of Fire Fighting on Pulmonary Function. *N. Engl. J. Med. 291*: 1320 (1974).

4 **Sammons, J. H. and R. L. Coleman**: Firefighters Occupational Exposure to Carbon Monoxide. *J. Occup. Med. 16*: 543 (1974).

5 **Boettner, E. A. and B. Weiss**: *Combustion Products from the Incineration of Plastics*. EPA-670/273049.

6 **Dufour, R. E.**: Survey of Available Information on the Toxicity of the Combustion and Thermal Decomposition Products of Certain Building Materials Under Fire Conditions. *Underwriters Laboratories Bulletin of Research*. No. 53, July 1963.

7 **Tewarson, A.**: *Some Observations on Experimental Fires in Enclosures*. Factory Mutual Research Corp. Serv. No. 18305, July 1971.

8 **Vodvarka, F. J.**: *Urban Burns - Full Scale Field Studies*. Engineering Mechanics Division, IIT Research Institute Project J6171, Jan. 1970.

9 **Gordon, G. S. and R. L. Rogers**: *Project Monoxide*. International Association of Fire Fighters, Washington, DC 20006 (1969).

10 **Environmental Protection Agency**: *Air Quality Criteria for Nitrogen Oxides*. Air Pollution Control Office, Washington, DC (1971).

11 **Gross, D., J. J. Loftus, T. G. Lee and W. E. Gray**: *Smoke and Gases Produced by Burning Aircraft Interior Materials*. Building Science Series 18, National Bureau of Standards, Washington, DC (1969).

12 **Levaggi, D. A., W. Siu and M. Feldstein**: A New Method for Measuring Average 24-Hour Nitrogen Dioxide Concentrations in the Atmosphere. *J. Air Poll. Contr. Assoc. 23*: 30 (1973).

13 **Blacker, J. H.**: Triethanolamine for Collecting Nitrogen Dioxide in the TLV Range. *Am. Ind. Hyg. Assoc. J. 34*: 390 (1973).

14 **Zall, D. M., D. Fisher and M. Q. Garner**: Photometric Determination of Chlorides in Water. *Anal. Chem. 28*: 1665 (1956).

15 **Humphrey, R. E., R. R. Clark, L. Houston and D. J. Kippenburger**: Measurement of Chloride Ion by Ultraviolet Absorption of Mercury Complexes. *Anal. Chem. 44*: 1299 (1972).

16 **Humphrey, R. E. and W. L. Hinze**: Determination of Chloride by Spectrophotometric Measurement of Mercuric Chloride with Phenolphthalein Complexone or Xylenol Orange. *Anal. Chem. 45*: 1747 (1973).

17 **Bertolacini, R. J. and J. E. Barney**: Ultraviolet Spectrophotometric Determination of Sulfate, Chloride and Fluoride with Chloranilic Acid. *Anal. Chem. 30*: 202 (1958).

18 **Lambert, J. L., J. Ramasamy and J. V. Paukstelis**: Stable Reagents for the Colorimetric Determination of Cyanide by Modified Konig Reactions. *Anal. Chem. 47*: 916 (1975).

19 **Hounam, R. F.**: An Application of the Lognormal Distribution to Some Air Sampling Results and Recommendations on the Interpretation of Air Sampling Data. Atomic Energy Research Establishment Report AERE-M 1469. Her Majesty's Stationary Office, London, England, 1965.

20 **American Conference of Governmental Industrial Hygienists**: *Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1976*.

CYANIDE, TOTAL

Method 335.2 (Titrimetric; Spectrophotometric)

STORET NO. 00720

1. Scope and Application
   1.1 This method is applicable to the determination of cyanide in drinking, surface and saline waters, domestic and industrial wastes.
   1.2 The titration procedure using silver nitrate with p-dimethylamino-benzal-rhodanine indicator is used for measuring concentrations of cyanide exceeding 1 mg/l (0.25 mg/250 ml of absorbing liquid).
   1.3 The colorimetric procedure is used for concentrations below 1 mg/l of cyanide and is sensitive to about 0.02 mg/l.
2. Summary of Method
   2.1 The cyanide as hydrocyanic acid (HCN) is released from cyanide complexes by means of a reflux-distillation operation and absorbed in a scrubber containing sodium hydroxide solution. The cyanide ion in the absorbing solution is then determined by volumetric titration or colorimetrically.
   2.2 In the colorimetric measurement the cyanide is converted to cyanogen chloride, CNCl, by reaction with chloramine-T at a pH less than 8 without hydrolyzing to the cyanate. After the reaction is complete, color is formed on the addition of pyridine-pyrazolone or pyridine-barbituric acid reagent. The absorbance is read at 620 nm when using pyridine-pyrazolone or 578 nm for pyridine-barbituric acid. To obtain colors of comparable intensity, it is essential to have the same salt content in both the sample and the standards.
   2.3 The titrimetric measurement uses a standard solution of silver nitrate to titrate cyanide in the presence of a silver sensitive indicator.
3. Definitions
   3.1 Cyanide is defined as cyanide ion and complex cyanides converted to hydrocyanic acid (HCN) by reaction in a reflux system of a mineral acid in the presence of magnesium ion.
4. Sample Handling and Preservation
   4.1 The sample should be collected in plastic or glass bottles of 1 liter or larger size. All bottles must be thoroughly cleansed and thoroughly rinsed to remove soluble material from containers.
   4.2 Oxidizing agents such as chlorine decompose most of the cyanides. Test a drop of the sample with potassium iodide-starch test paper (KI-starch paper); a blue color indicates the need for treatment. Add ascorbic acid, a few crystals at a time, until a drop of sample produces no color on the indicator paper. Then add an additional 0.06 g of ascorbic acid for each liter of sample volume.

Approved for NPDES
Issued 1974
Editorial revision 1974 and 1978
Technical Revision 1980

4.3 Samples must be preserved with 2 ml of 10 N sodium hydroxide per liter of sample (pH ≥ 12) at the time of collection.

4.4 Samples should be analyzed as rapidly as possible after collection. If storage is required, the samples should be stored in a refrigerator or in an ice chest filled with water and ice to maintain temperature at 4°C.

5. Interferences

5.1 Interferences are eliminated or reduced by using the distillation procedure described in Procedure 8.1, 8.2 and 8.3.

5.2 Sulfides adversely affect the colorimetric and titration procedures. Samples that contain hydrogen sulfide, metal sulfides or other compounds that may produce hydrogen sulfide during the distillation should be distilled by the optional procedure described in Procedure 8.2. The apparatus for this procedure is shown in Figure 3.

5.3 Fatty acids will distill and form soaps under the alkaline titration conditions, making the end point almost impossible to detect.

5.3.1 Acidify the sample with acetic acid (1 + 9) to pH 6.0 to 7.0.

Caution: This operation must be performed in the hood and the sample left there until it can be made alkaline again after the extraction has been performed.

5.3.2 Extract with iso-octane, hexane, or chloroform (preference in order named) with a solvent volume equal to 20% of the sample volume. One extraction is usually adequate to reduce the fatty acids below the interference level. Avoid multiple extractions or a long contact time at low pH in order to keep the loss of HCN at a minimum. When the extraction is completed, immediately raise the pH of the sample to above 12 with NaOH solution.

5.4 High results may be obtained for samples that contain nitrate and/or nitrite. During the distillation nitrate and nitrite will form nitrous acid which will react with some organic compounds to form oximes. These compounds formed will decompose under test conditions to generate HCN. The interference of nitrate and nitrite is eliminated by pretreatment with sulfamic acid.

6. Apparatus

6.1 Reflux distillation apparatus such as shown in Figure 1 or Figure 2. The boiling flask should be of 1 liter size with inlet tube and provision for condenser. The gas absorber may be a Fisher-Milligan scrubber.

6.2 Microburet, 5.0 ml (for titration).

6.3 Spectrophotometer suitable for measurements at 578 nm or 620 nm with a 1.0 cm cell or larger.

6.4 Reflux distillation apparatus for sulfide removal as shown in Figure 3. The boiling flask same as 6.1. The sulfide scrubber may be a Wheaton Bubber #709682 with 29/42 joints, size 100 ml. The air inlet tube should not be fritted. The cyanide absorption vessel should be the same as the sulfide scrubber. The air inlet tube should be fritted.

6.5 Flow meter, such as Lab Crest with stainless steel float (Fisher 11-164-50).

7. Reagents

7.1 Sodium hydroxide solution, 1.25N: Dissolve 50 g of NaOH in distilled water, and dilute to 1 liter with distilled water.

7.2 Lead acetate: Dissolve 30 g of $Pb(C_2H_3O_2)\cdot 3H_2O$ in 950 ml of distilled water. Adjust the pH to 4.5 with acetic acid. Dilute to 1 liter.

7.5 Sulfuric acid: 18N: Slowly add 500 ml of concentrated H_2SO_4 to 500 ml of distilled water.

7.6 Sodium dihydrogenphosphate, 1 M: Dissolve 138 g of $NaH_2PO_4\cdot H_2O$ in 1 liter of distilled water. Refrigerate this solution.

7.7 Stock cyanide solution: Dissolve 2.51 g of KCN and 2 g KOH in 900 ml of distilled water. Standardize with 0.0192 N $AgNO_3$. Dilute to appropriate concentration so that 1 ml = 1 mg CN.

7.8 Standard cyanide solution, intermediate: Dilute 100.0 ml of stock (1 ml = 1 mg CN) to 1000 ml with distilled water (1 ml = 100.0 ug).

7.9 Working standard cyanide solution: Prepare fresh daily by diluting 100.0 ml of intermediate cyanide solution to 1000 ml with distilled water and store in a glass stoppered bottle. 1 ml = 10.0 ug CN.

7.10 Standard silver nitrate solution, 0.0192 N: Prepare by crushing approximately 5 g $AgNO_3$ crystals and drying to constant weight at 40°C. Weigh out 3.2647 g of dried $AgNO_3$, dissolve in distilled water, and dilute to 1000 ml (1 ml = 1mg CN).

7.11 Rhodanine indicator: Dissolve 20 mg of p-dimethyl-amino-benzalrhodanine in 100 ml of acetone.

7.12 Chloramine T solution: Dissolve 1.0 g of white, water soluble Chloramine T in 100 ml of distilled water and refrigerate until ready to use. Prepare fresh daily.

7.13 Color Reagent — One of the following may be used:

7.13.1 Pyridine-Barbituric Acid Reagent: Place 15 g of barbituric acid in a 250 ml volumetric flask and add just enough distilled water to wash the sides of the flask and wet the barbituric acid. Add 75 ml of pyridine and mix. Add 15 ml of conc. HCl, mix, and cool to room temperature. Dilute to 250 ml with distilled water and mix. This reagent is stable for approximately six months if stored in a cool, dark place.

7.13.2 Pyridine-pyrazolone solution:

7.13.2.1 3-Methyl-1-phenyl-2-pyrazolin-5-one reagent, saturated solution: Add 0.25 g of 3-methyl-1-phenyl-2-pyrazolin-5-one to 50 ml of distilled water, heat to 60°C with stirring. Cool to room temperature.

7.13.2.2 3,3'Dimethyl-1, 1'-diphenyl-[4,4'-bi-2 pyrazoline]-5,5'dione (bispyrazolone): Dissolve 0.01 g of bispyrazolone in 10 ml of pyridine.

7.13.2.3 Pour solution (7.13.2.1) through non-acid-washed filter paper. Collect the filtrate. Through the same filter paper pour solution (7.13.2.2) collecting the filtrate in the same container as filtrate from (7.13.2.1). Mix until the filtrates are homogeneous. The mixed reagent develops a pink color but this does not affect the color production with cyanide if used within 24 hours of preparation.

7.14 Magnesium chloride solution: Weight 510 g of $MgCl_2\cdot 6H_2O$ into a 1000 ml flask, dissolve and dilute to 1 liter with distilled water.

7.15 Sulfamic acid.

8. Procedure

8.1 For samples without sulfide.

8.1.1 Place 500 ml of sample, or an aliquot diluted to 500 ml in the 1 liter boiling flask. Pipet 50 ml of sodium hydroxide (7.1) into the absorbing tube. If the apparatus in Figure 1 is used, add distilled water until the spiral is covered. Connect the boiling flask, condenser, absorber and trap in the train. (Figure 1 or 2)

8.1.2 Start a slow stream of air entering the boiling flask by adjusting the vacuum source. Adjust the vacuum so that approximately two bubbles of air per second enters the boiling flask through the air inlet tube. Proceed to 8.4.

8.2 For samples that contain sulfide.

8.2.1 Place 500 ml of sample, or an aliquot diluted to 500 ml in the 1 liter boiling flask. Pipet 50 ml of sodium hydroxide (7.1) to the absorbing tube. Add 25 ml of lead acetate (7.2) to the sulfide scrubber. Connect the boiling flask, condenser, scrubber and absorber in the train. (Figure 3) The flow meter is connected to the outlet tube of the cyanide absorber.

8.2.2 Start a stream of air entering the boiling flask by adjusting the vacuum source. Adjust the vacuum so that approximately 1.5 liters per minute enters the boiling flask through the air inlet tube. The bubble rate may not remain constant while heat is being applied to the flask. It may be necessary to readjust the air rate occasionally. Proceed to 8.4.

8.3 If samples contain NO_3 and or NO_2 add 2 g of sulfamic acid solution (7.15) after the air rate is set through the air inlet tube. Mix for 3 minutes prior to addition of H_2SO_4.

8.4 Slowly add 50 ml 18N sulfuric acid (7.5) through the air inlet tube. Rinse the tube with distilled water and allow the airflow to mix the flask contents for 3 min. Pour 20 ml of magnesium chloride (7.14) into the air inlet and wash down with a stream of water.

8.5 Heat the solution to boiling. Reflux for one hour. Turn off heat and continue the airflow for at least 15 minutes. After cooling the boiling flask, disconnect absorber and close off the vacuum source.

8.6 Drain the solution from the absorber into a 250 ml volumetric flask. Wash the absorber with distilled water and add the washings to the flask. Dilute to the mark with distilled water.

8.7 Withdraw 50 ml or less of the solution from the flask and transfer to a 100 ml volumetric flask. If less than 50 ml is taken, dilute to 50 ml with 0.25N sodium hydroxide solution (7.4). Add 15.0 ml of sodium phosphate solution (7.6) and mix.

8.7.1 Pyridine-barbituric acid method: Add 2 ml of chloramine T (7.12) and mix. See Note 1. After 1 to 2 minutes, add 5 ml of pyridine-barbituric acid solution (7.13.1) and mix. Dilute to mark with distilled water and mix again. Allow 8 minutes for color development then read absorbance at 578 nm in a 1 cm cell within 15 minutes.

8.7.2 Pyridine-pyrazolene method: Add 0.5 ml of chloramine T (7.12) and mix. See Note 1 and 2. After 1 to 2 minutes add 5 ml of pyridine-pyrazolone solution

(7.13.1) and mix. Dilute to mark with distilled water and mix again. After 40 minutes read absorbance at 620 nm in a 1 cm cell.

NOTE 1: Some distillates may contain compounds that have a chlorine demand. One minute after the addition of chloramine T, test for residual chlorine with KI-starch paper. If the test is negative, add an additional 0.5 ml of chlorine T. After one minute, recheck the sample.

NOTE 2: More than 05. ml of chloramine T will prevent the color from developing with pyridine-pyrazolone.

8.8 Standard curve for samples without sulfide.

8.8.1 Prepare a series of standards by pipeting suitable volumes of standard solution (7.9) into 250 ml volumetric flasks. To each standard add 50 ml of 1.25 N sodium hydroxide and dilute to 250 ml with distilled water. Prepare as follows:

ML of Working Standard Solution (1 ml = 10 μg CN)	Conc. μg CN per 250 ml
0	BLANK
1.0	10
2.0	20
5.0	50
10.0	100
15.0	150
20.0	200

8.8.2 It is not imperative that all standards be distilled in the same manner as the samples. It is recommended that at least two standards (a high and low) be distilled and compared to similar values on the curve to insure that the distillation technique is reliable. If distilled standards do not agree within ±10% of the undistilled standards the analyst should find the cause of the apparent error before proceeding.

8.8.3 Prepare a standard curve by plotting absorbance of standard vs. cyanide concentrations.

8.8.4 To check the efficiency of the sample distillation, add an increment of cyanide from either the intermediate standard (7.8) or the working standard (7.9) to 500 ml of sample to insure a level of 20 μg/l. Proceed with the analysis as in Procedure (8.1.1).

8.9 Standard curve for samples with sulfide.

8.9.1 It is imperative that all standards be distilled in the same manner as the samples. Standards distilled by this method will give a linear curve, but as the concentration increases, the recovery decreases. It is recommended that at least 3 standards be distilled.

8.9.2 Prepare a standard curve by plotting absorbance of standard vs. cyanide concentrations.

8.10 Titrimetric method.

8.10.1 If the sample contains more than 1 mg/l of CN, transfer the distillate or a suitable aliquot diluted to 250 ml, to a 500 ml Erlenmeyer flask. Add 10-12 drops of the benzalrhodanine indicator.

8.10.2 Titrate with standard silver nitrate to the first change in color from yellow to brownish-pink. Titrate a distilled water blank using the same amount of sodium hydroxide and indicator as in the sample.

8.10.3 The analyst should familiarize himself with the end point of the titration and the amount of indicator to be used before actually titrating the samples.

9. Calculation

9.1 If the colorimetric procedure is used, calculate the cyanide, in *ug*/l, in the original sample as follows:

$$CN, ug/l = \frac{A \times 1{,}000}{B} \times \frac{50}{C}$$

where:

A = *ug* CN read from standard curve
B = ml of original sample for distillation
C = ml taken for colorimetric analysis

9.2 Using the titrimetric procedure, calculate concentration of CN as follows:

$$CN, \text{ mg } l = \frac{(A - B)1{,}000}{\text{ml orig. sample}} \times \frac{250}{\text{ml of aliquot titrated}}$$

where:

A = volume of $AgNO_3$ for titration of sample.
B = volume of $AgNO_3$ for titration of blank.

10. Precision and Accuracy
    10.1 In a single laboratory (EMSL), using mixed industrial and domestic waste samples at concentrations of 0.06, 0.13, 0.28 and 0.62 mg/1 CN, the standard deviations were ±0.005, ±0.007, ±0.031 and ±0.094, respectively.
    10.2 In a single laboratory (EMSL), using mixed industrial and domestic waste samples at concentrations of 0.28 and 0.62 mg/1 CN, recoveries were 85% and 102%, respectively.

Bibliography

1. Bark, L. S., and Higson, H. G. "Investigation of Reagents for the Colorimetric Determination of Small Amounts of Cyanide", Talanta, 2:471–479 (1964).
2. Elly, C. T. "Recovery of Cyanides by Modified Serfass Distillation". Journal Water Pollution Control Federation 40:848–856 (1968).
3. Annual Book of ASTM Standards, Part 31, "Water", Standard D2036–75, Method A, p 503 (1976).
4. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 367 and 370, Method 413B and D (1975).
5. Egekeze, J. O., and Oehne, F. W., "Direct Potentiometric Determination of Cyanide in Biological Materials," J. Analytical Toxicology, Vol. 3, p. 119, May/June 1979.
6. Casey, J. P., Bright, J. W., and Helms, B. D., "Nitrosation Interference in Distillation Tests for Cyanide." Gulf Coast Waste Disposal Authority, Houston, Texas.

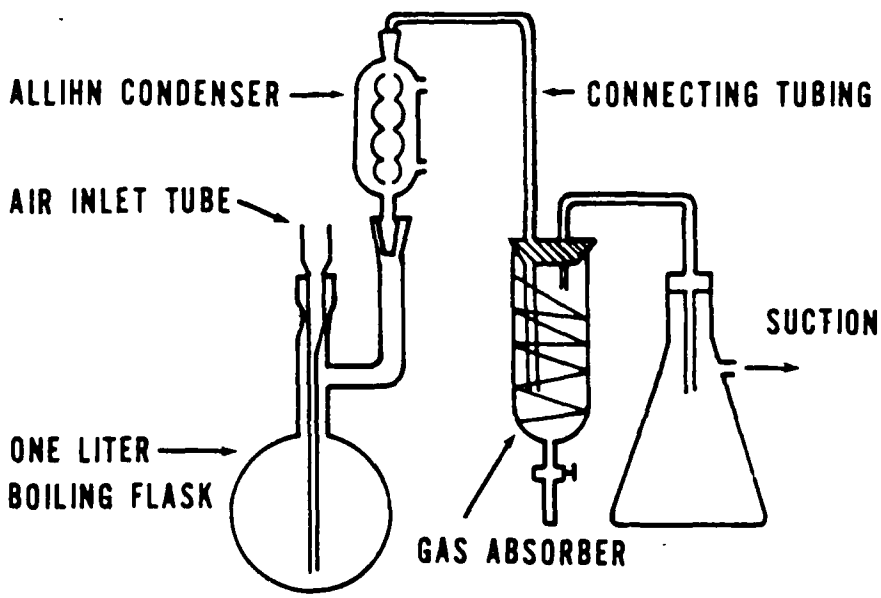


FIGURE 1

CYANIDE DISTILLATION APPARATUS

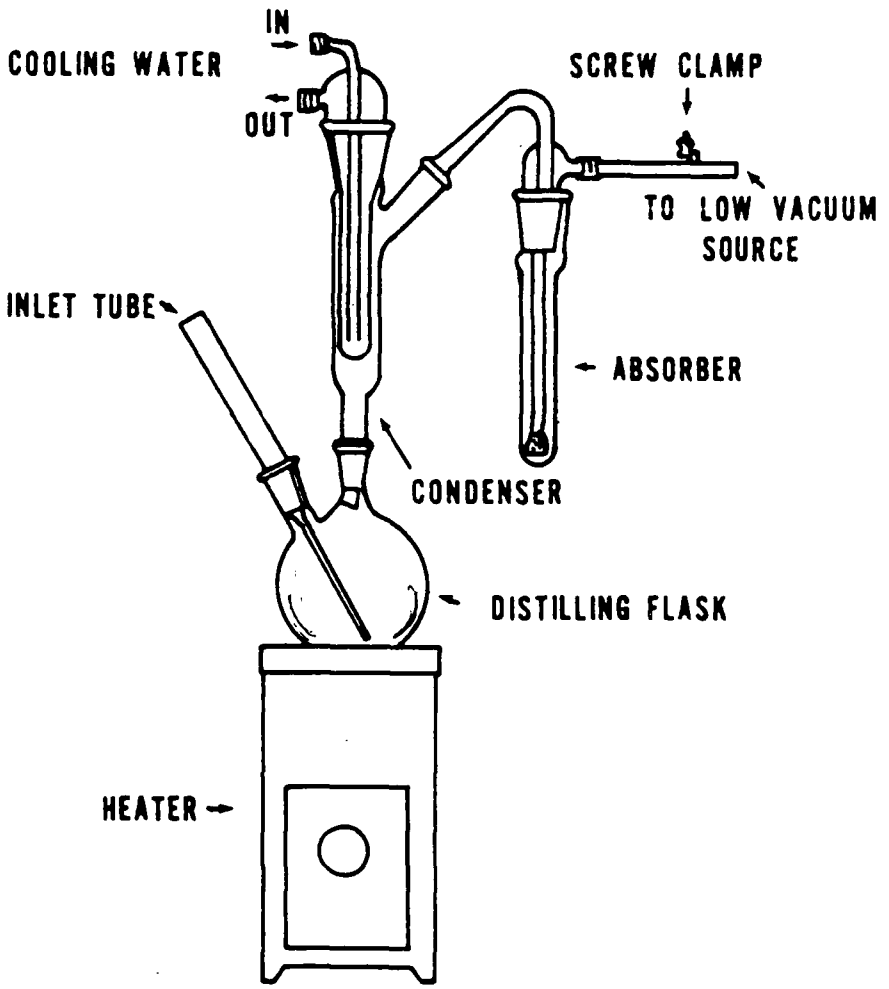


FIGURE 2
CYANIDE DISTILLATION APPARATUS

NITROGEN DIOXIDE - GENERAL AREA

NITROGEN DIOXIDE AND NITRIC OXIDE IN AIR

Measurements Support Branch

Analytical Method

Analyte: Nitrogen Dioxide and Nitric Oxide	**Method No.:** P&CAM 231
Matrix: Air	**Range:** 0.8 to 30 ppm of NO_2 or NO in a 1-liter sample
Procedure: Solid sorbent collection; triethanolamine extraction; spectrophotometry	**Precision(CV_T):** NO_2, 0.07 at 0.5 to 5 ppm; NO, 0.06 at 12.5 to 50 ppm
	Classification: D (Operational)
Date Issued: 6/30/76	
Date Revised:	

1. **Principle of the Method**

Nitrogen dioxide (NO_2) and nitric oxide (NO) are collected from air in a three-section sorbent tube. The NO_2 is absorbed in the first section, which contains triethanolamine (TEA) impregnated on molecular sieve. The NO is converted to NO_2 by a proprietary oxidizer in the second section. The NO_2 thus formed from the NO is absorbed in the third section by another bed of TEA-impregnated molecular sieve. The first and third sections are desorbed with solutions of TEA in water and the nitrite in these solutions is determined spectrophotometrically by the Griess-Saltzman reaction. (Reference 11.1). The nitrite found in the first section is reported as NO_2 and the nitrite in the third section is reported as NO.

2. **Range and Sensitivity**

2.1 The linear range of the standard curve is from 0.5 to 18 μg of nitrite in 10 mℓ of desorbing solution, which corresponds in this method to a range of 0.8 to 30 ppm of NO_2 or NO in a 1-liter sample of air.

2.2 The sensitivity is 0.4 μg/10 mℓ for an absorbance of 0.04.

2.3 The upper limit of the range can be extended by taking smaller aliquots for analysis, or be diluting intensely colored solutions with water.

3. **Interferences**

3.1 Inorganic nitrites cause positive interference.

3.2 Nitric acid and nitrates do not interfere.

3.3 Ammonia does not interfere.

4. **Precision and Accuracy**

4.1 The average recovery for 22 samples in the range 0.5 to 5 ppm of NO_2 was greater than 96% and the coefficient of variation was 0.07.

4.2 For 18 samples the average recovery of NO varied with the amount of NO collected. The recovery was 100% at 12.5 ppm. At 25 ppm only 84% recovery was achieved, and at 50 ppm only 67%. However, the coefficient of variation over the range was only 0.06. The recovery may vary depending upon the sample flow rate and the properties of the particular lot of oxidizer used. Each laboratory should determine the efficiency of the sampling tubes employed.

4.3 The accuracy of the overall sampling and analytical method has not been determined.

5. **Advantages and Disadvantages of the Method**

5.1 Both nitrogen dioxide and nitric oxide are collected simultaneously.

5.2 This method is simple and convenient for field sampling.

5.3 Samples can be stored at ambient temperature for at least 10 days without any effect on the results.

5.4 At 50 ppm of NO the collection efficiency is poor (about 67%) because the oxidizer is consumed.

5.5 If high humidity or water mist is present, the breakthrough volume can be severely reduced. If water condenses in the tube, NO_2 and NO may not be collected quantitatively.

6. **Apparatus**

6.1 **Sampling Equipment**

6.1.1 Solid sorbent tubes are made in the following manner. Using a gas-oxygen torch, heat a section of 5-mm i.d., 7-mm o.d. Pyrex glass tubing and pull it

apart to form a tube approximately 15 cm long with a taper 2 cm long. Seal the tapered end of the tube in the flame. Allow it to cool, then insert a small plug of glass wool through the open end of the tube; push the glass wool through the open end of the tube with a thin wooden stick and pack gently. Weigh 400 mg of TEA sorbent and pour the material into the tube. (See Section 7.2) Gently tap the tube on the table top several times to ensure uniform packing. Insert another small plug of glass wool to keep the TEA sorbent in place. For the next section, pour 800 mg of oxidizer into the tube. (See Section 7.1.) Again tap the tube and insert a plug of glass wool; pack lightly. Insert another plug of glass wool, maintaining an air gap of 12 mm between these two plugs. Weigh 400 mg of TEA sorbent and pour the material into the tube. Carefully tap the tube and gently pack another glass wool plug without closing the 12-mm air gap. Seal the open end of the tube with the torch. See the figure on page 231-9.

6.1.2 A personal sampling pump that can provide a flow rate of 50 mℓ/min within 5% accuracy is required. The pump should be calibrated with a representative sorbent tube in the sampling line. A dry or wet test meter or glass rotameter that will determine the flow rate to within 5% may be used for the calibration.

6.2 Spectrophotometer capable of measurements at 540 nm.

6.3 Matched glass cells or cuvettes, 1-cm path length.

6.4 Assorted laboratory glassware: pipettes, glass-stoppered graduated cylinders, and volumetric flasks of appropriate sizes.

7. **Reagents**

7.1 **Oxidizer.** Proprietary material Number 1900277 from the Drägerwerk Company of West Germany, supplied through its U.S. distributor, National Mine Safety Company, or the equivalent.

7.2 **TEA Sorbent.** Place 25 g of triethanolamine in a 250-mℓ beaker; add 4 g of glycerol, 50 mℓ of acetone and sufficient distilled water to bring the volume up to 100 mℓ. To the mixture add about 50 mℓ of Type 13X, 30/40-mesh Molecular Sieve. Stir and let stand in a covered beaker for about 30 min. Decant the excess liquid, and transfer the molecular sieve to a porcelain pan. Place the pan under a heating lamp until most of the moisture has evaporated. Complete the drying in an oven at 110°C for 1 hr. The sorbent should be free flowing. Store it in a closed glass container.

7.3 **Desorbing Solution.** Dissolve 15.0 g of triethanolamine in approximately 500 mℓ of distilled water, add 0.5 mℓ of *n*-butanol, and dilute to 1 liter.

7.4 **Hydrogen Peroxide, 0.02%(v/v).** Dilute 0.2 mℓ of 30% hydrogen peroxide to 250 mℓ with distilled water.

7.5 **Sulfanilamide Solution.** Dissolve 10 g of sulfanilamide in 400 mℓ of distilled water. Add 25 mℓ of concentrated phosphoric acid, mix well, and dilute to 500 mℓ.

7.6 **NEDA Solution.** Dissolve 0.5 gm of N-(1-naphthyl)ethylenediamine dihydrochloride in 500 mℓ of distilled water.

7.7 **Nitrite Stock Standard Solution (100 μg/mℓ).** Dissolve 0.1500 g of reagent grade sodium nitrite in distilled water and dilute to 1 liter.

8. **Procedure**

8.1 **Cleaning of Equipment.** Wash all glassware with detergent solution, soak in nitric acid, rinse in tap water and distilled water, and then rinse thoroughly with double distilled water.

8.2 **Collection and Shipping of Samples**

8.2.1 Before sampling. break open the ends of the sorbent tube to provide an opening that is approximately one-half the internal diameter of the tube.

8.2.2 The air must flow through the 12-mm air space before it flows through the oxidizer. Therefore attach the end of the tube without the air gap between the oxidizer section and TEA sorbent section to the pump with a length of small diameter Tygon® tubing.

8.2.3 Mount the tube in a vertical position to avoid channeling.

8.2.4 The air being sampled should not pass through any hose or tubing before it enters the sorbent tube.

8.2.5 Turn on the pump to begin sample collection. Sample at a flow rate of 50 mℓ/min or less to obtain a maximum sample volume of 1 liter. Measure the flow rate and time, or volume, as accurately as possible. If a low flow rate pump is used, set the rate to an approximate value and record the initial and final stroke counter readings. Obtain the sample volume by multiplying the number of strokes by the stroke volume.

8.2.6 Measure and record the temperature and pressure of the atmosphere being sampled.

8.2.7 Cap the sorbent tubes with 7-mm i.d. plastic caps immediately after sampling. (Masking tape can be substituted for the plastic caps.)

8.2.8 With each batch of samples, submit one blank sorbent tube. This tube is handled in the same manner as the other tubes (break, seal, and transport) except that no air is drawn through it. When more than ten samples are submitted, include an additional blank for every ten samples.

8.2.9 Pack the capped sorbent tubes tightly and pad them to minimize breakage during shipping.

8.3 **Analysis of Samples**

8.3.1 With tweezers remove and discard the glass wool plugs from an exposed sorbent tube and transfer each TEA sorbent bed to separate, 25-mℓ glass-stoppered graduated cylinders. Label the graduated cylinder as to the location of the TEA sorbent with respect to the oxidizer section.

8.3.2 To each graduated cylinder add enough of the desorbing solution to make the volume up to 20 mℓ, and shake the mixture vigorously for about 30 sec.

8.3.3 Allow a few minutes for the solids to settle, and then transfer 10 mℓ to another 25-mℓ glass-stoppered graduated cylinder.

8.3.4 Develop the color of the solution for 10 min in the same manner as described for the preparation of the standard curve (Sections 9.4 to 9.6). From the standard curve determine the amount of nitrite in the 10-mℓ aliquot.

8.4 **Determination of Collection and Desorption Efficiencies**

8.4.1 **Importance of Determination.** The collection and desorption efficiencies of a given compound can vary from one laboratory to another and also from one batch of sorbent tubes to another. Thus, it is necessary to determine at least once the percentages of sample collected and then removed in the desorption process. Results indicate that the recovery of NO varies with the amount of NO collected, particularly at higher concentrations (for example, at 50 ppm).

8.4.2 **Procedure for Determining Collection and Desorption Efficiencies.** Sorbent tubes from the same batch as that used in obtaining samples are used in this determination. Known volumes of NO_2 and NO are injected into a bag containing a known volume of air. The bag is made of Tedlar (or another material that will not absorb NO_2 or NO) and should have a gas sampling valve and a septum injection port. The concentrations of NO_2 and NO in the bag may be calculated at room temperature and pressure. A measured volume is then sampled through a sorbent tube with a calibrated sampling pump. At least five tubes are prepared in this manner. These tubes are desorbed and analyzed in the same manner as the samples (Section 8.3).

8.4.3 **Calculation of Desorption Efficiency.** The desorption efficiency (D.E.) is the average concentration (corrected for the blank) of NO_2 or NO found by analysis of the sorbent tubes divided by the concentration of NO_2 or NO in the bag.

9. **Calibration and Standards**

9.1 Dilute 2 mℓ of the nitrite stock standard (100 μg/mℓ) to 100 mℓ with the desorbing solution to prepare a solution with a nitrite concentration of 2 μg/mℓ.

9.2 To a series of 25-mℓ glass-stoppered graduated cylinders add 1, 3, 5, 7, and 9 mℓ of the dilute standard solution.

9.3 Add enough of the absorbing solution to bring the volume in each cylinder up to 10 mℓ to prepare working standards with nitrite concentrations of 2, 6, 10, 14, and 18 μg/10 mℓ.

9.4 To each graduated cylinder, add 1 mℓ of the 0.02% hydrogen peroxide solution, 10 mℓ of the sulfanilamide solution, and 1.4 mℓ of the NEDA solution, with thorough mixing after the addition of each reagent.

9.5 Allow 10 min for complete color development.

9.6 Measure the absorbance of the solutions at 540 nm, using a reagent blank in the reference cell.

9.7 Prepare a standard curve by plotting absorbance *versus* weight of nitrite (in μg) in 10 mℓ of the desorbing solution.

10. Calculations

10.1 From the standard curve, read the weight of nitrite (in μg) in 10 mℓ of the desorbing solution corresponding to the absorbance of the sample solution. Multiply this weight by 2 to determine the total amount (in μg) of nitrite extracted with 2.0 mℓ of desorbing solution from the sorbent section being analyzed. The calibration procedure is based upon the empirical observation that 0.63 mole of sodium nitrite produces the same absorbance in the color-developed solution as 1 mole of NO_2. (See Reference 11.2.) Divide the amount of nitrite desorbed from the sorbent material by 0.63 to determine the apparent amount of NO_2 collected in the sorbent section. These calculations are summarized in the following equation:

$$W = \frac{\mu g\ NO_2^- \times 2}{0.63}$$

where: W = weight (in μg) of NO_2 found.

10.2 Correct the amount of NO_2 calculated in Section 10.1 for the amount of NO_2, if any, found on the corresponding sorbent section of a blank tube to obtain the amount of NO_2 in the sample, as follows:

$$W_s = W - W_b$$

where: W_s = corrected weight (in μg) of NO_2 in sample.

W_b = weight (in μg) of NO_2 in the corresponding section of a blank tube.

10.3 The concentration of NO_2 in parts per million (ppm) by volume in the air sample is calculated as follows:

$$ppm = \frac{W_s}{V} \times \frac{24.45}{M.W.} \times \frac{760}{P} \times \frac{T+273}{298}$$

where: V = volume (liters) of air sampled.
M.W.= molecular weight.
24.45= molar volume (liter/mole) at 25°C and 760 mmHg.
P = pressure (mmHg) of air sampled.
T = temperature (C°) of air sampled.

10.4 The ppm of NO_2 found in the third section (downstream from the oxidizer) is reported as ppm of NO.

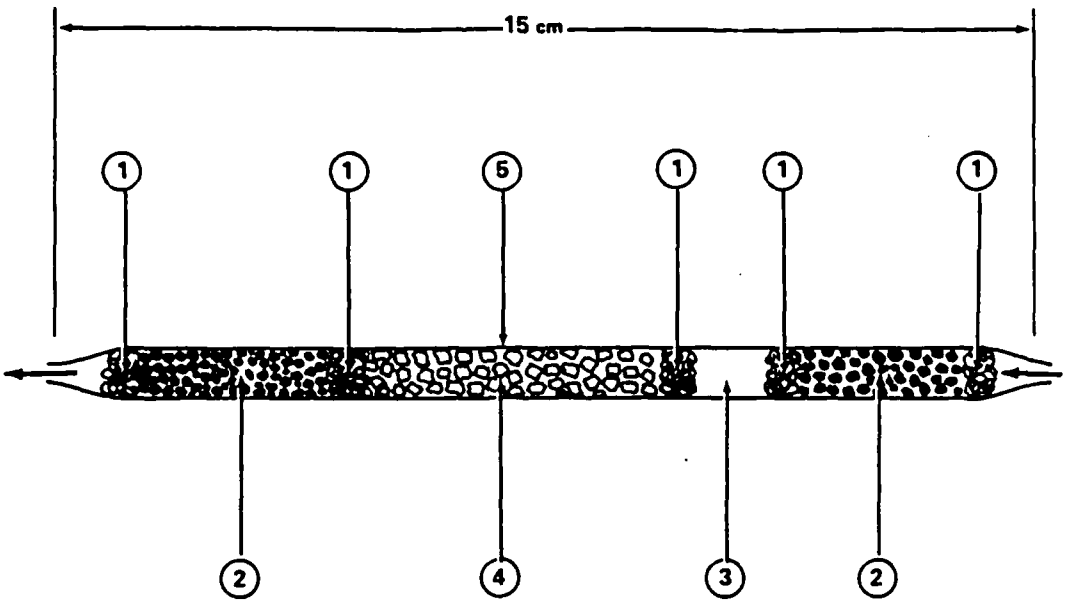
11. References

11.1 Saltzman, B.E. "Colorimetric Microdetermination of Nitrogen Dioxide in the Atmosphere," **Anal. Chem.**, 26, 1949 (1954).

11.2 Blacker, J. H., "Triethanolamine for Collecting Nitrogen Dioxide in the TLV Range," **Am. Ind. Hyg. Assoc. J.**, 34, 390 (1973).

11.3 NIOSH Sampling Data Sheet No. 32.01, "NIOSH Manual of Sampling Data Sheets," Measurements Research Branch, Division of Physical Sciences and Engineering, National Institute for Occupational Safety and Health, December 22, 1975.

11.4 Willey, M.A., C. S. McCammon, Jr., and L. J. Doemeny, "A Solid Sorbent Personal Sampling Method for the Simultaneous Collection of Nitrogen Dioxide and Nitric Oxide in Air," presented at the American Industrial Hygiene Association Conference, Atlanta, Georgia, May 1976.



1. GLASS WOOL PLUGS
2. TEA SORBENT, 400 mg
3. AIR GAP, 12 mm
4. OXIDIZER, 800 mg
5. GLASS TUBE, 5 mm i.d.

SORBENT TUBE FOR NO_2 and NO

This page intentionally blank.

APPENDIX B

ANALYTICAL DATA

This page intentionally blank.

CARBON MONOXIDE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	ARAPRSN	ANALYTE	BOOLEAN	FIRECONC	IOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VIOC	GROUP
1	5300	FBB11ACCO1	F	B	B	1	1	A	C	CO1		430	490	10.20	4	1	1	BBFV	A	NON
2	5301	FBB11ADCO1	F	B	B	1	1	A	D	CO1		80	490	10.20	2	1	2	BBFV	A	NON
3	5302	FBB11ALCO1	F	B	B	1	1	A	L	CO1		90	490	10.20	2	1	3	BBFV	A	NON
4	5303	FBB11BCCO1	F	B	B	1	1	B	C	CO1		560	490	10.20	3	1	4	BBFV	A	NON
5	5304	FBB11BDCO1	F	B	B	1	1	B	D	CO1		100	490	10.20	1	1	5	BBFV	A	NON
6	5305	FBB11BLCO1	F	B	B	1	1	B	L	CO1		220	490	10.20	2	1	6	BBFV	A	NON
7	5306	FBB12ACCO1	F	B	B	1	2	A	C	CO1		350	411	9.96	3	1	1	BBFV	A	NON
8	5308	FBB12ALCO1	F	B	B	1	2	A	L	CO1		130	411	9.96	1	1	3	BBFV	A	NON
9	5309	FBB12BCCO1	F	B	B	1	2	B	C	CO1		350	411	9.96	2	1	4	BBFV	A	NON
10	5310	FBB12BDCO1	F	B	B	1	2	B	D	CO1		240	411	9.96	3	1	5	BBFV	A	NON
11	5311	FBB12BLCO1	F	B	B	1	2	B	L	CO1		260	411	9.96	2	1	6	BBFV	A	NON
12	5312	FBB13ACCO1	F	B	B	1	3	A	C	CO1		120	239	5.08	2	1	1	BBFV	A	NON
13	5313	FBB13ADCO1	F	B	B	1	3	A	D	CO1		130	239	5.08	2	1	2	BBFV	A	NON
14	5314	FBB13ALCO1	F	B	B	1	3	A	L	CO1		80	239	5.08	1	1	3	BBFV	A	NON
15	5315	FBB13BCCO1	F	B	B	1	3	B	C	CO1		170	239	5.08	1	1	4	BBFV	A	NON
16	5316	FBB13BDCO1	F	B	B	1	3	B	D	CO1		270	239	5.08	1	1	5	BBFV	A	NON
17	5317	FBB13BLCO1	F	B	B	1	3	B	L	CO1		170	239	5.08	2	1	6	BBFV	A	NON
18	5318	FBB14ACCO1	F	B	B	1	4	A	C	CO1		410	424	10.00	3	1	1	BBFV	A	NON
19	5319	FBB14ADCO1	F	B	B	1	4	A	D	CO1		80	424	10.00	1	1	2	BBFV	A	NON
20	5320	FBB14ALCO1	F	B	B	1	4	A	L	CO1		70	424	10.00	1	1	3	BBFV	A	NON
21	5321	FBB14BCCO1	F	B	B	1	4	B	C	CO1		370	424	10.00	2	1	4	BBFV	A	NON
22	5322	FBB14BDCO1	F	B	B	1	4	B	D	CO1		40	424	10.00	0	1	5	BBFV	A	NON
23	5323	FBB14BLCO1	F	B	B	1	4	B	L	CO1		210	424	10.00	3	1	6	BBFV	A	NON
24	5324	FBB15ACCO1	F	B	B	1	5	A	C	CO1		800	487	13.10	10	1	1	BBFV	A	NON
25	5325	FBB15ADCO1	F	B	B	1	5	A	D	CO1		220	487	13.10	3	1	2	BBFV	A	NON
26	5326	FBB15ALCO1	F	B	B	1	5	A	L	CO1		170	487	13.10	4	1	3	BBFV	A	NON
27	5327	FBB15BCCO1	F	B	B	1	5	B	C	CO1		960	487	13.10	6	1	4	BBFV	A	NON
28	5328	FBB15BDCO1	F	B	B	1	5	B	D	CO1		200	487	13.10	13	1	5	BBFV	A	NON
29	5329	FBB15BLCO1	F	B	B	1	5	B	L	CO1		620	487	13.10	7	1	6	BBFV	A	NON
30	5330	FBB21ACCO1	F	B	B	2	1	A	C	CO1		1290	467	12.75	9	1	1	BBFV	A	NON
31	5331	FBB21ADCO1	F	B	B	2	1	A	D	CO1		180	467	12.75	4	1	2	BBFV	A	NON
32	5332	FBB21ALCO1	F	B	B	2	1	A	L	CO1		260	467	12.75	6	1	3	BBFV	A	NON
33	5333	FBB21BCCO1	F	B	B	2	1	B	C	CO1		530	467	12.75	3	1	4	BBFV	A	NON
34	5334	FBB21BDCO1	F	B	B	2	1	B	D	CO1		240	467	12.75	6	1	5	BBFV	A	NON
35	5335	FBB21BLCO1	F	B	B	2	1	B	L	CO1		540	467	12.75	6	1	6	BBFV	A	NON
36	5336	FBB22ACCO1	F	B	B	2	2	A	C	CO1		660	463	12.35	9	1	1	BBFV	A	NON
37	5337	FBB22ADCO1	F	B	B	2	2	A	D	CO1		590	463	12.35	10	1	2	BBFV	A	NON
38	5338	FBB22ALCO1	F	B	B	2	2	A	L	CO1		600	463	12.35	10	1	3	BBFV	A	NON
39	5339	FBB22BCCO1	F	B	B	2	2	B	C	CO1		670	463	12.35	5	1	4	BBFV	A	NON
40	5340	FBB22BDCO1	F	B	B	2	2	B	D	CO1		510	463	12.35	11	1	5	BBFV	A	NON
41	5341	FBB22BLCO1	F	B	B	2	2	B	L	CO1		570	463	12.35	8	1	6	BBFV	A	NON
42	5342	FBB23ACCO1	F	B	B	2	3	A	C	CO1		480	206	6.05	4	1	1	BBFV	A	NON
43	5343	FBB23ADCO1	F	B	B	2	3	A	D	CO1		200	206	6.05	3	1	2	BBFV	A	NON
44	5344	FBB23ALCO1	F	B	B	2	3	A	L	CO1		1020	206	6.05	11	1	3	BBFV	A	NON
45	5345	FBB23BCCO1	F	B	B	2	3	B	C	CO1		570	206	6.05	4	1	4	BBFV	A	NON
46	5346	FBB23BDCO1	F	B	B	2	3	B	D	CO1		140	206	6.05	2	1	5	BBFV	A	NON
47	5347	FBB23BLCO1	F	B	B	2	3	B	L	CO1		250	206	6.05	3	1	6	BBFV	A	NON
48	5348	FBB24ACCO1	F	B	B	2	4	A	C	CO1		1280	329	12.05	7	1	1	BBFV	A	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	5350	FBB24ALCO1	F	B	B	2	4	A	L	CO1		360	329	12.05	5	1	3	BBFV	A	NON
50	5351	FBB24BCCO1	F	B	B	2	4	B	C	CO1		970	329	12.05	6	1	4	BBFV	A	NON
51	5352	FBB24BDCO1	F	B	B	2	4	B	D	CO1		250	329	12.05	3	1	5	BBFV	A	NON
52	5353	FBB24BLCO1	F	B	B	2	4	B	L	CO1		900	329	12.05	4	1	6	BBFV	A	NON
53	5354	FBB25ACCO1	F	B	B	2	5	A	C	CO1		240	382	11.53	5	1	1	BBFV	A	NON
54	5355	FBB25ADCO1	F	B	B	2	5	A	D	CO1		410	382	11.53	6	1	2	BBFV	A	NON
55	5356	FBB25ALCO1	F	B	B	2	5	A	L	CO1		160	382	11.53	5	1	3	BBFV	A	NON
56	5357	FBB25BCCO1	F	B	B	2	5	B	C	CO1		460	382	11.53	7	1	4	BBFV	A	NON
57	5358	FBB25BDCO1	F	B	B	2	5	B	D	CO1		180	382	11.53	15	1	5	BBFV	A	NON
58	5359	FBB25BLCO1	F	B	B	2	5	B	L	CO1		320	382	11.53	6	1	6	BBFV	A	NON
59	5400	FCM11ACCO1	F	C	M	1	1	A	C	CO1		360	12	144.00	16	1	1	CM10	D	NON
60	5402	FCM11ALCO1	F	C	M	1	1	A	L	CO1		240	12	144.00	4	1	3	CM10	D	NON
61	5403	FCM11BCCO1	F	C	M	1	1	B	C	CO1		170	12	144.00	4	1	4	CM10	D	NON
62	5404	FCM11BDCO1	F	C	M	1	1	B	D	CO1		140	12	144.00	4	1	5	CM10	D	NON
63	5406	FCM11BLCO1	F	C	M	1	1	B	L	CO1		340	12	144.00	5	1	6	CM10	D	NON
64	5408	FCM12ADCO1	F	C	M	1	2	A	D	CO1		30	2	24.00	0	1	2	CM10	D	NON
65	5409	FCM12ALCO1	F	C	M	1	2	A	L	CO1		30	2	24.00	0	1	3	CM10	D	NON
66	5410	FCM12BCCO1	F	C	M	1	2	B	C	CO1		120	2	24.00	0	1	4	CM10	D	NON
67	5411	FCM12BDCO1	F	C	M	1	2	B	D	CO1		10	2	24.00	0	1	5	CM10	D	NON
68	5413	FCM12BLCO1	F	C	M	1	2	B	L	CO1		50	2	24.00	0	1	6	CM10	D	NON
69	5424	FCM14BCCO1	F	C	M	1	4	B	C	CO1		2280	2	24.00	13	1	4	CM10	D	NON
70	5500	FCT11ACCO1	F	C	T	1	1	A	C	CO1		560	161	64.20	71	1	1	CTAN	C	TANK
71	5501	FCT11ADCO1	F	C	T	1	1	A	D	CO1		560	161	64.20	113	1	2	CTAN	C	TANK
72	5502	FCT11ALCO1	F	C	T	1	1	A	L	CO1		600	161	64.20	77	1	3	CTAN	C	TANK
73	5503	FCT11BCCO1	F	C	T	1	1	B	C	CO1		690	161	64.20	33	1	4	CTAN	C	TANK
74	5504	FCT11BDCO1	F	C	T	1	1	B	D	CO1		480	161	64.20	66	1	5	CTAN	C	TANK
75	5505	FCT11BLCO1	F	C	T	1	1	B	L	CO1		670	161	64.20	64	1	6	CTAN	C	TANK
76	5506	FCT12ACCO1	F	C	T	1	2	A	C	CO1		1110	117	69.45	28	1	1	CTAN	C	TANK
77	5507	FCT12ADCO1	F	C	T	1	2	A	D	CO1		110	117	69.45	7	1	2	CTAN	C	TANK
78	5508	FCT12ALCO1	F	C	T	1	2	A	L	CO1		450	117	69.45	16	1	3	CTAN	C	TANK
79	5509	FCT12BCCO1	F	C	T	1	2	B	C	CO1		670	117	69.45	7	1	4	CTAN	C	TANK
80	5510	FCT12BDCO1	F	C	T	1	2	B	D	CO1		130	117	69.45	12	1	5	CTAN	C	TANK
81	5561	FCT12BGCO1	F	C	T	1	2	B	G	CO1		900	117	69.45	17	1	7	CTAN	C	TANK
82	5512	FCT13ACCO1	F	C	T	1	3	A	C	CO1		430	160	58.50	19	1	1	CTAN	C	TANK
83	5513	FCT13ADCO1	F	C	T	1	3	A	D	CO1		220	160	58.50	10	1	2	CTAN	C	TANK
84	5514	FCT13ALCO1	F	C	T	1	3	A	L	CO1		1090	160	58.50	34	1	3	CTAN	C	TANK
85	5515	FCT13BCCO1	F	C	T	1	3	B	C	CO1		750	160	58.50	10	1	4	CTAN	C	TANK
86	5516	FCT13BDCO1	F	C	T	1	3	B	D	CO1		2260	160	58.50	11	1	5	CTAN	C	TANK
87	5562	FCT13BGCO1	F	C	T	1	3	B	G	CO1		470	160	58.50	83	1	7	CTAN	C	TANK
88	5517	FCT13BLCO1	F	C	T	1	3	B	L	CO1		610	160	58.50	44	1	6	CTAN	C	TANK
89	5518	FCT14ACCO1	F	C	T	1	4	A	C	CO1		30	163	75.60	1	1	1	CTAN	C	TANK
90	5519	FCT14ADCO1	F	C	T	1	4	A	D	CO1		260	163	75.60	21	1	2	CTAN	C	TANK
91	5520	FCT14ALCO1	F	C	T	1	4	A	L	CO1		80	163	75.60	2	1	3	CTAN	C	TANK
92	5522	FCT14BCCO1	F	C	T	1	4	B	C	CO1		510	163	75.60	64	1	4	CTAN	C	TANK
93	5523	FCT14BDCO1	F	C	T	1	4	B	D	CO1		2260	163	75.60	31	1	5	CTAN	C	TANK
94	5563	FCT14BGCO1	F	C	T	1	4	B	G	CO1		1560	163	75.60	19	1	7	CTAN	C	TANK
95	5524	FCT14BLCO1	F	C	T	1	4	B	L	CO1		460	163	75.60	22	1	6	CTAN	C	TANK
96	5525	FCT15ACCO1	F	C	T	1	5	A	C	CO1		320	156	35.70	37	1	1	CTAN	C	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
97	5526	FCT15ADC01	F	C	T	1	5	A	D	C01		880	156	35.70	42	1	2	CTAN	C	TANK
98	5529	FCT15ALC01	F	C	T	1	5	A	L	C01		710	156	35.70	31	1	3	CTAN	C	TANK
99	5530	FCT21ACC01	F	C	T	2	1	A	C	C01		510	162	69.90	78	1	1	CTAN	C	TANK
100	5531	FCT21ADC01	F	C	T	2	1	A	D	C01		320	162	69.90	94	1	2	CTAN	C	TANK
101	5532	FCT21ALC01	F	C	T	2	1	A	L	C01		820	162	69.90	80	1	3	CTAN	C	TANK
102	5533	FCT21BCC01	F	C	T	2	1	B	C	C01		1330	162	69.90	26	1	4	CTAN	C	TANK
103	5534	FCT21BDC01	F	C	T	2	1	B	D	C01		420	162	69.90	91	1	5	CTAN	C	TANK
104	5564	FCT21BGC01	F	C	T	2	1	B	G	C01		660	162	69.90	108	1	7	CTAN	C	TANK
105	5535	FCT21BLC01	F	C	T	2	1	B	L	C01		820	162	69.90	79	1	6	CTAN	C	TANK
106	5536	FCT22ACC01	F	C	T	2	2	A	C	C01		2270	166	92.70	103	1	1	CTAN	C	TANK
107	5537	FCT22ADC01	F	C	T	2	2	A	D	C01		630	166	92.70	64	1	2	CTAN	C	TANK
108	5538	FCT22ALC01	F	C	T	2	2	A	L	C01		540	166	92.70	40	1	3	CTAN	C	TANK
109	5539	FCT22BCC01	F	C	T	2	2	B	C	C01		370	166	92.70	16	1	4	CTAN	C	TANK
110	5540	FCT22BDC01	F	C	T	2	2	B	D	C01		470	166	92.70	67	1	5	CTAN	C	TANK
111	5565	FCT22BGC01	F	C	T	2	2	B	G	C01		790	166	92.70	48	1	7	CTAN	C	TANK
112	5542	FCT23ACC01	F	C	T	2	3	A	C	C01		2280	161	64.20	44	1	1	CTAN	C	TANK
113	5543	FCT23ADC01	F	C	T	2	3	A	D	C01		280	161	64.20	8	1	2	CTAN	C	TANK
114	5544	FCT23ALC01	F	C	T	2	3	A	L	C01		190	161	64.20	4	1	3	CTAN	C	TANK
115	5545	FCT23BCC01	F	C	T	2	3	B	C	C01		1330	161	64.20	11	1	4	CTAN	C	TANK
116	5546	FCT23BDC01	F	C	T	2	3	B	D	C01		220	161	64.20	7	1	5	CTAN	C	TANK
117	5566	FCT23BGC01	F	C	T	2	3	B	G	C01		1160	161	64.20	17	1	7	CTAN	C	TANK
118	5547	FCT23BLC01	F	C	T	2	3	B	L	C01		600	161	64.20	9	1	6	CTAN	C	TANK
119	5548	FCT24ACC01	F	C	T	2	4	A	C	C01		900	156	35.70	7	1	1	CTAN	C	TANK
120	5549	FCT24ADC01	F	C	T	2	4	A	D	C01		80	156	35.70	2	1	2	CTAN	C	TANK
121	5550	FCT24ALC01	F	C	T	2	4	A	L	C01		680	156	35.70	3	1	3	CTAN	C	TANK
122	5551	FCT24BCC01	F	C	T	2	4	B	C	C01		1010	156	35.70	6	1	4	CTAN	C	TANK
123	5552	FCT24BDC01	F	C	T	2	4	B	D	C01		570	156	35.70	3	1	5	CTAN	C	TANK
124	5567	FCT24BGC01	F	C	T	2	4	B	G	C01		940	156	35.70	12	1	7	CTAN	C	TANK
125	5553	FCT24BLC01	F	C	T	2	4	B	L	C01		2140	156	35.70	10	1	6	CTAN	C	TANK
126	5554	FCT25ACC01	F	C	T	2	5	A	C	C01		770	160	58.50	13	1	1	CTAN	C	TANK
127	5555	FCT25ADC01	F	C	T	2	5	A	D	C01		420	160	58.50	10	1	2	CTAN	C	TANK
128	5556	FCT25ALC01	F	C	T	2	5	A	L	C01		820	160	58.50	28	1	3	CTAN	C	TANK
129	5600	FKA11ACC01	F	K	A	1	1	A	C	C01		2060	215	86.10	60	1	1	KM1	E	TANK
130	5601	FKA11ADC01	F	K	A	1	1	A	D	C01		580	215	86.10	20	1	2	KM1	E	TANK
131	5602	FKA11ALC01	F	K	A	1	1	A	L	C01		2290	215	86.10	60	1	3	KM1	E	TANK
132	5605	FKA11BGC01	F	K	A	1	1	B	G	C01		2290	215	86.10	70	1	7	KM1	E	TANK
133	5606	FKA11BLC01	F	K	A	1	1	B	L	C01		2290	215	86.10	80	1	6	KM1	E	TANK
134	5608	FKA12ADC01	F	K	A	1	2	A	D	C01		830	51	119.79	20	1	2	KM1	E	TANK
135	5609	FKA12ALC01	F	K	A	1	2	A	L	C01		2270	51	119.79	30	1	3	KM1	E	TANK
136	5610	FKA12BCC01	F	K	A	1	2	B	C	C01		1820	51	119.79	40	1	4	KM1	E	TANK
137	5611	FKA12BDC01	F	K	A	1	2	B	D	C01		1090	51	119.79	20	1	5	KM1	E	TANK
138	5612	FKA12BGC01	F	K	A	1	2	B	G	C01		1950	51	119.79	30	1	7	KM1	E	TANK
139	5613	FKA12BLC01	F	K	A	1	2	B	L	C01		2290	51	119.79	100	1	6	KM1	E	TANK
140	5614	FKA13ACC01	F	K	A	1	3	A	C	C01		2000	272	126.15	40	1	1	KM1	E	TANK
141	5615	FKA13ADC01	F	K	A	1	3	A	D	C01		670	272	126.15	10	1	2	KM1	E	TANK
142	5617	FKA13BCC01	F	K	A	1	3	B	C	C01		2120	272	126.15	50	1	4	KM1	E	TANK
143	5618	FKA13BDC01	F	K	A	1	3	B	D	C01		940	272	126.15	40	1	5	KM1	E	TANK
144	5619	FKA13BGC01	F	K	A	1	3	B	G	C01		1150	272	126.15	50	1	7	KM1	E	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
145	5620	FKA13BLCO1	F	K	A	1	3	B	L	CO1		1560	272	126.15	40	1	6	KM1	E	TANK
146	5622	FKA14ADCO1	F	K	A	1	4	A	D	CO1		140	118	102.90	10	1	2	KM1	E	TANK
147	5623	FKA14ALCO1	F	K	A	1	4	A	L	CO1		1940	118	102.90	10	1	3	KM1	E	TANK
148	5624	FKA14BCCO1	F	K	A	1	4	B	C	CO1		750	118	102.90	10	1	4	KM1	E	TANK
149	5626	FKA14BGCO1	F	K	A	1	4	B	G	CO1		1120	118	102.90	20	1	7	KM1	E	TANK
150	5627	FKA14BLCO1	F	K	A	1	4	B	L	CO1		2280	118	102.90	590	1	6	KM1	E	TANK
151	5631	FKA21ACCO1	F	K	A	2	1	A	C	CO1		2280	178	160.05	70	1	1	KM1	E	TANK
152	5632	FKA21ADCO1	F	K	A	2	1	A	D	CO1		1280	178	160.05	30	1	2	KM1	E	TANK
153	5633	FKA21ALCO1	F	K	A	2	1	A	L	CO1		1300	178	160.05	40	1	3	KM1	E	TANK
154	5634	FKA21BCCO1	F	K	A	2	1	B	C	CO1		1970	178	160.05	50	1	4	KM1	E	TANK
155	5635	FKA21BDCO1	F	K	A	2	1	B	D	CO1		1410	178	160.05	40	1	5	KM1	E	TANK
156	5636	FKA21BGCO1	F	K	A	2	1	B	G	CO1		1970	178	160.05	60	1	7	KM1	E	TANK
157	5637	FKA21BLCO1	F	K	A	2	1	B	L	CO1		1890	178	160.05	50	1	6	KM1	E	TANK
158	5639	FKA22ADCO1	F	K	A	2	2	A	D	CO1		1220	124	137.10	10	1	2	KM1	E	TANK
159	5640	FKA22ALCO1	F	K	A	2	2	A	L	CO1		1280	124	137.10	10	1	3	KM1	E	TANK
160	5641	FKA22BCCO1	F	K	A	2	2	B	C	CO1		2160	124	137.10	10	1	4	KM1	E	TANK
161	5643	FKA22BGCO1	F	K	A	2	2	B	G	CO1		960	124	137.10	0	1	7	KM1	E	TANK
162	5644	FKA22BLCO1	F	K	A	2	2	B	L	CO1		1920	124	137.10	20	1	6	KM1	E	TANK
163	5645	FKA23ACCO1	F	K	A	2	3	A	C	CO1		2280	125	142.80	30	1	1	KM1	E	TANK
164	5646	FKA23ADCO1	F	K	A	2	3	A	D	CO1		580	125	142.80	10	1	2	KM1	E	TANK
165	5647	FKA23ALCO1	F	K	A	2	3	A	L	CO1		1740	125	142.80	20	1	3	KM1	E	TANK
166	5648	FKA23BCCO1	F	K	A	2	3	B	C	CO1		2200	125	142.80	30	1	4	KM1	E	TANK
167	5649	FKA23BDCO1	F	K	A	2	3	B	D	CO1		600	125	142.80	10	1	5	KM1	E	TANK
168	5650	FKA23BGCO1	F	K	A	2	3	B	G	CO1		2310	125	142.80	30	1	7	KM1	E	TANK
169	5651	FKA23BLCO1	F	K	A	2	3	B	L	CO1		2300	125	142.80	30	1	6	KM1	E	TANK
170	5653	FKA24ADCO1	F	K	A	2	4	A	D	CO1		200	30	171.00	0	1	2	KM1	E	TANK
171	5654	FKA24ALCO1	F	K	A	2	4	A	L	CO1		640	30	171.00	20	1	3	KM1	E	TANK
172	5655	FKA24BCCO1	F	K	A	2	4	B	C	CO1		230	30	171.00	0	1	4	KM1	E	TANK
173	5656	FKA24BDCO1	F	K	A	2	4	B	D	CO1		230	30	171.00	0	1	5	KM1	E	TANK
174	5657	FKA24BGCO1	F	K	A	2	4	B	G	CO1		990	30	171.00	10	1	7	KM1	E	TANK
175	5658	FKA24BLCO1	F	K	A	2	4	B	L	CO1		1320	30	171.00	20	1	6	KM1	E	TANK
176	5700	FKT11ACCO1	F	K	T	1	1	A	C	CO1		320	552	155.48	20	1	1	KTAN	F	TANK
177	5701	FKT11ADCO1	F	K	T	1	1	A	D	CO1		450	552	155.48	20	1	2	KTAN	F	TANK
178	5702	FKT11ALCO1	F	K	T	1	1	A	L	CO1		560	552	155.48	20	1	3	KTAN	F	TANK
179	5704	FKT11BDCO1	F	K	T	1	1	B	D	CO1		390	552	155.48	40	1	5	KTAN	F	TANK
180	5705	FKT11BGCO1	F	K	T	1	1	B	G	CO1		1910	552	155.48	40	1	7	KTAN	F	TANK
181	5706	FKT11BLCO1	F	K	T	1	1	B	L	CO1		2290	552	155.48	90	1	6	KTAN	F	TANK
182	5707	FKT12ACCO1	F	K	T	1	2	A	C	CO1		1030	327	154.80	70	1	1	KTAN	F	TANK
183	5708	FKT12ADCO1	F	K	T	1	2	A	D	CO1		580	327	154.80	40	1	2	KTAN	F	TANK
184	5709	FKT12ALCO1	F	K	T	1	2	A	L	CO1		2290	327	154.80	90	1	3	KTAN	F	TANK
185	5710	FKT12BCCO1	F	K	T	1	2	B	C	CO1		1310	327	154.80	60	1	4	KTAN	F	TANK
186	5711	FKT12BDCO1	F	K	T	1	2	B	D	CO1		650	327	154.80	50	1	5	KTAN	F	TANK
187	5712	FKT12BGCO1	F	K	T	1	2	B	G	CO1		1640	327	154.80	70	1	7	KTAN	F	TANK
188	5713	FKT12BLCO1	F	K	T	1	2	B	L	CO1		1980	327	154.80	100	1	6	KTAN	F	TANK
189	5714	FKT13ACCO1	F	K	T	1	3	A	C	CO1		40	331	177.60	0	1	1	KTAN	F	TANK
190	5715	FKT13ADCO1	F	K	T	1	3	A	D	CO1		250	331	177.60	20	1	2	KTAN	F	TANK
191	5716	FKT13ALCO1	F	K	T	1	3	A	L	CO1		1610	331	177.60	30	1	3	KTAN	F	TANK
192	5717	FKT13BCCO1	F	K	T	1	3	B	C	CO1		2280	331	177.60	10	1	4	KTAN	F	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
193	5719	FKT13BGC01	F	K	T	1	3	B	G	C01		1440	331	177.60	20	1	7	KTAN	F	TANK
194	5720	FKT13BLC01	F	K	T	1	3	B	L	C01		2170	331	177.60	30	1	6	KTAN	F	TANK
195	5721	FKT14ACC01	F	K	T	1	4	A	C	C01		520	577	155.55	20	1	1	KTAN	F	TANK
196	5722	FKT14ADC01	F	K	T	1	4	A	D	C01		380	577	155.55	20	1	2	KTAN	F	TANK
197	5723	FKT14ALC01	F	K	T	1	4	A	L	C01		2220	577	155.55	40	1	3	KTAN	F	TANK
198	5724	FKT14BCC01	F	K	T	1	4	B	C	C01		1470	577	155.55	20	1	4	KTAN	F	TANK
199	5725	FKT14BDC01	F	K	T	1	4	B	D	C01		720	577	155.55	40	1	5	KTAN	F	TANK
200	5726	FKT14BGC01	F	K	T	1	4	B	G	C01		2060	577	155.55	40	1	7	KTAN	F	TANK
201	5727	FKT14BLC01	F	K	T	1	4	B	L	C01		2270	577	155.55	50	1	6	KTAN	F	TANK
202	5200	FSM11ACC01	F	S	M	1	1	A	C	C01		70	7	84.00	2	1	1	SM10	B	NON
203	5201	FSM11ADC01	F	S	M	1	1	A	D	C01		920	7	84.00	5	1	2	SM10	B	NON
204	5202	FSM11ALC01	F	S	M	1	1	A	L	C01		220	7	84.00	3	1	3	SM10	B	NON
205	5203	FSM11BCC01	F	S	M	1	1	B	C	C01		80	7	84.00	3	1	4	SM10	B	NON
206	5204	FSM11BDC01	F	S	M	1	1	B	D	C01		70	7	84.00	0	1	5	SM10	B	NON
207	5205	FSM11BLC01	F	S	M	1	1	B	L	C01		80	7	84.00	3	1	6	SM10	B	NON
208	5206	FSM12ACC01	F	S	M	1	2	A	C	C01		160	12	144.00	3	1	1	SM10	B	NON
209	5207	FSM12ADC01	F	S	M	1	2	A	D	C01		200	12	144.00	2	1	2	SM10	B	NON
210	5208	FSM12ALC01	F	S	M	1	2	A	L	C01		170	12	144.00	2	1	3	SM10	B	NON
211	5209	FSM12BCC01	F	S	M	1	2	B	C	C01		130	12	144.00	2	1	4	SM10	B	NON
212	5210	FSM12BDC01	F	S	M	1	2	B	D	C01		540	12	144.00	3	1	5	SM10	B	NON
213	5211	FSM12BLC01	F	S	M	1	2	B	L	C01		220	12	144.00	3	1	6	SM10	B	NON
214	5212	FSM13ACC01	F	S	M	1	3	A	C	C01		70	12	144.00	2	1	1	SM10	B	NON
215	5215	FSM13BCC01	F	S	M	1	3	B	C	C01		70	12	144.00	1	1	4	SM10	B	NON
216	5216	FSM13BDC01	F	S	M	1	3	B	D	C01		120	12	144.00	13	1	5	SM10	B	NON
217	5217	FSM13BLC01	F	S	M	1	3	B	L	C01		100	12	144.00	2	1	6	SM10	B	NON
218	5218	FSM14ACC01	F	S	M	1	4	A	C	C01		2250	16	192.00	18	1	1	SM10	B	NON
219	5219	FSM14ADC01	F	S	M	1	4	A	D	C01		460	16	192.00	8	1	2	SM10	B	NON
220	5220	FSM14ALC01	F	S	M	1	4	A	L	C01		410	16	192.00	7	1	3	SM10	B	NON
221	5221	FSM14BCC01	F	S	M	1	4	B	C	C01		440	16	192.00	5	1	4	SM10	B	NON
222	5223	FSM14BLC01	F	S	M	1	4	B	L	C01		2270	16	192.00	20	1	6	SM10	B	NON
223	5224	FSM15ACC01	F	S	M	1	5	A	C	C01		110	13	156.00	2	1	1	SM10	B	NON
224	5225	FSM15ADC01	F	S	M	1	5	A	D	C01		450	13	156.00	3	1	2	SM10	B	NON
225	5226	FSM15ALC01	F	S	M	1	5	A	L	C01		80	13	156.00	1	1	3	SM10	B	NON

This page intentionally blank.

CARBON DIOXIDE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTI	BOTTLEAN	FIRECONC	TOTCAT	TOTMASS	IOICONC	SELECT	IREAT	VTYPFOR	VLOC	GROUP
1	4300	FBB11ACCO2	F	B	B		1	A	C	CO2		1120	490	10.20	610	1	1	BBFV	A	NON
2	4301	FBB11ADCO2	F	B	B	1	1	A	D	CO2		1860	490	10.20	795	1	2	BBFV	A	NON
3	4302	FBB11ALCO2	F	B	B	1	1	A	L	CO2		1680	490	10.20	751	1	3	BBFV	A	NON
4	4303	FBB12ACCO2	F	B	B	1	2	A	C	CO2		1640	411	9.96	660	1	1	BBFV	A	NON
5	4304	FBB12ADCO2	F	B	B	1	2	A	D	CO2		1670	411	9.96	666	1	2	BBFV	A	NON
6	4305	FBB12ALCO2	F	B	B	1	2	A	L	CO2		1840	411	9.96	699	1	3	BBFV	A	NON
7	4306	FBB15ACCO2	F	B	B	1	5	A	C	CO2		1360	487	13.10	632	1	1	BBFV	A	NON
8	4307	FBB15ADCO2	F	B	B	1	5	A	D	CO2		1760	487	13.10	722	1	2	BBFV	A	NON
9	4309	FBB23ACCO2	F	B	B	2	3	A	C	CO2		1580	206	6.05	658	1	1	BBFV	A	NON
10	4310	FBB23ADCO2	F	B	B	2	3	A	D	CO2		1240	206	6.05	586	1	2	BBFV	A	NON
11	4311	FBB23ALCO2	F	B	B	2	3	A	L	CO2		1550	206	6.05	650	1	3	BBFV	A	NON
12	4313	FBB24ADCO2	F	B	B	2	4	A	D	CO2		1250	329	12.05	667	1	2	BBFV	A	NON
13	4314	FBB24ALCO2	F	B	B	2	4	A	L	CO2		1000	329	12.05	605	1	3	BBFV	A	NON
14	4400	FCM11ACCO2	F	C	M	1	1	A	C	CO2		1130	12	144.00	640	1	1	CM10	D	NON
15	4401	FCM11ADCO2	F	C	M	1	1	A	D	CO2		1040	12	144.00	615	1	2	CM10	D	NON
16	4402	FCM11ALCO2	F	C	M	1	1	A	L	CO2		1040	12	144.00	615	1	3	CM10	D	NON
17	4403	FCM12ACCO2	F	C	M	1	2	A	C	CO2	>	778	2	24.00	415	1	1	CM10	D	NON
18	4404	FCM12ADCO2	F	C	M	1	2	A	D	CO2		1290	2	24.00	728	1	2	CM10	D	NON
19	4405	FCM12ALCO2	F	C	M	1	2	A	L	CO2		1100	2	24.00	673	1	3	CM10	D	NON
20	4500	FCT11ACCO2	F	C	T	1	1	A	C	CO2		3110	161	64.20	959	1	1	CTAN	C	TANK
21	4501	FCT11ADCO2	F	C	T	1	1	A	D	CO2		2980	161	64.20	945	1	2	CTAN	C	TANK
22	4503	FCT11ALCO2	F	C	T	1	1	A	L	CO2		3310	161	64.20	1010	1	3	CTAN	C	TANK
23	4504	FCT12ACCO2	F	C	T	1	2	A	C	CO2		3140	117	69.45	891	1	1	CTAN	C	TANK
24	4505	FCT12ADCO2	F	C	T	1	2	A	D	CO2		3720	117	69.45	971	1	2	CTAN	C	TANK
25	4507	FCT12ALCO2	F	C	T	1	2	A	L	CO2		2100	117	69.45	683	1	3	CTAN	C	TANK
26	4509	FCT15ADCO2	F	C	T	1	5	A	D	CO2		2880	156	35.70	1100	1	2	CTAN	C	TANK
27	4511	FCT15ALCO2	F	C	T	1	5	A	L	CO2		3540	156	35.70	1270	1	3	CTAN	C	TANK
28	4512	FCT23ACCO2	F	C	T	2	3	A	C	CO2		1760	161	64.20	515	1	1	CTAN	C	TANK
29	4513	FCT23ADCO2	F	C	T	2	3	A	D	CO2		3830	161	64.20	733	1	2	CTAN	C	TANK
30	4515	FCT23ALCO2	F	C	T	2	3	A	L	CO2		1860	161	64.20	525	1	3	CTAN	C	TANK
31	4516	FCT24ACCO2	F	C	T	2	4	A	C	CO2	>	5710	156	35.70	769	1	1	CTAN	C	TANK
32	4517	FCT24ADCO2	F	C	T	2	4	A	D	CO2		4150	156	35.70	650	1	2	CTAN	C	TANK
33	4519	FCT24ALCO2	F	C	T	2	4	A	L	CO2		3090	156	35.70	568	1	3	CTAN	C	TANK
34	4600	FKA11ACCO2	F	K	A	1	1	A	C	CO2		670	215	86.10	870	1	1	KM1	E	TANK
35	4601	FKA11ADCO2	F	K	A	1	1	A	D	CO2		1050	215	86.10	1180	1	2	KM1	E	TANK
36	4603	FKA11ALCO2	F	K	A	1	1	A	L	CO2		590	215	86.10	806	1	3	KM1	E	TANK
37	4604	FKA12ACCO2	F	K	A	1	2	A	C	CO2		886	51	119.79	915	1	1	KM1	E	TANK
38	4605	FKA12ADCO2	F	K	A	1	2	A	D	CO2	>	1120	51	119.79	1070	1	2	KM1	E	TANK
39	4608	FKA15ACCO2	F	K	A	1	5	A	C	CO2		723	51	119.79	808	1	1	KM1	E	TANK
40	4612	FKA23ACCO2	F	K	A	2	3	A	C	CO2		320	125	142.80	600	1	1	KM1	E	TANK
41	4613	FKA23ADCO2	F	K	A	2	3	A	D	CO2		420	125	142.80	685	1	2	KM1	E	TANK
42	4615	FKA23ALCO2	F	K	A	2	3	A	L	CO2		339	125	142.80	616	1	3	KM1	E	TANK
43	4616	FKA24ACCO2	F	K	A	2	4	A	C	CO2		586	30	171.00	832	1	1	KM1	E	TANK
44	4617	FKA24ADCO2	F	K	A	2	4	A	D	CO2		369	30	171.00	646	1	2	KM1	E	TANK
45	4619	FKA24ALCO2	F	K	A	2	4	A	L	CO2		272	30	171.00	563	1	3	KM1	E	TANK
46	4700	FKT11ACCO2	F	K	T	1	1	A	C	CO2	>	716	552	155.48	420	1	1	KTAN	F	TANK
47	4701	FKT11ADCO2	F	K	T	1	1	A	D	CO2	>	289	552	155.48	554	1	2	KTAN	F	TANK
48	4703	FKT11ALCO2	F	K	T	1	1	A	L	CO2	>	317	552	155.48	575	1	3	KTAN	F	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	ARLAPRSN	ANALYTE	BOLEAN	FIRECONC	IOICAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYFORT	VIOC	GROUP
49	4704	FKT12ACCO2	F	K	T	1	2	A	C	CO2	>	402	327	154.8	659	1	1	KTAN	F	TANK
50	4705	FKT12ADCO2	F	K	T	1	2	A	D	CO2	>	326	327	154.8	595	1	2	KTAN	F	TANK
51	4707	FKT12ALCO2	F	K	T	1	2	A	L	CO2	>	249	327	154.8	535	1	3	KTAN	F	TANK
52	4200	FSM11ACCO2	F	S	M	1	1	A	C	CO2		973	7	84.0	677	1	1	SM10	B	NON
53	4201	FSM11ADCO2	F	S	M	1	1	A	D	CO2		599	7	84.0	551	1	2	SM10	B	NON
54	4202	FSM11ALCO2	F	S	M	1	1	A	L	CO2		925	7	84.0	666	1	3	SM10	B	NON
55	4203	FSM12ACCO2	F	S	M	1	2	A	C	CO2		1220	12	144.0	778	1	1	SM10	B	NON
56	4204	FSM12ADCO2	F	S	M	1	2	A	D	CO2		890	12	144.0	646	1	2	SM10	B	NON
57	4206	FSM12ALCO2	F	S	M	1	2	A	L	CO2		976	12	144.0	675	1	3	SM10	B	NON
58	4207	FSM15ACCO2	F	S	M	1	5	A	C	CO2		1240	13	156.0	776	1	1	SM10	B	NON
59	4208	FSM15ADCO2	F	S	M	1	5	A	D	CO2		695	13	156.0	580	1	2	SM10	B	NON
60	4209	FSM15ALCO2	F	S	M	1	5	A	L	CO2		807	13	156.0	620	1	3	SM10	B	NON
61	4210	FSM23ACCO2	F	S	M	2	3	A	C	CO2		672	10	120.0	694	1	1	SM10	B	NON
62	4211	FSM23ADCO2	F	S	M	2	3	A	D	CO2		416	10	120.0	556	1	2	SM10	B	NON
63	4213	FSM23ALCO2	F	S	M	2	3	A	L	CO2		323	10	120.0	507	1	3	SM10	B	NON
64	4214	FSM24ACCO2	F	S	M	2	4	A	C	CO2		247	10	120.0	422	1	1	SM10	B	NON
65	4215	FSM24ADCO2	F	S	M	2	4	A	D	CO2		424	10	120.0	575	1	2	SM10	B	NON
66	4217	FSM24ALCO2	F	S	M	2	4	A	L	CO2		198	10	120.0	399	1	3	SM10	B	NON
67	4100	PSM11ACCO2	P	S	M	3	1	A	C	CO2	>	903	12	144.0	678	1	1	SM10	B	NON
68	4101	PSM11ADCO2	P	S	M	3	1	A	D	CO2	>	658	12	144.0	583	1	2	SM10	B	NON
69	4102	PSM11ALCO2	P	S	M	3	1	A	L	CO2	>	683	12	144.0	589	1	3	SM10	B	NON
70	4104	PSM12ACCO2	P	S	M	3	2	A	C	CO2	>	612	16	192.0	569	1	1	SM10	B	NON
71	4112	PSM23ACCO2	P	S	M	4	3	A	C	CO2		529	17	204.0	662	1	1	SM10	B	NON
72	4113	PSM23ADCO2	P	S	M	4	3	A	D	CO2		554	17	204.0	678	1	2	SM10	B	NON
73	4114	PSM23ALCO2	P	S	M	4	3	A	L	CO2		554	17	204.0	678	1	3	SM10	B	NON
74	4116	PSM24ACCO2	P	S	M	4	4	A	C	CO2		1110	16	192.0	1150	1	1	SM10	B	NON
75	4117	PSM24ADCO2	P	S	M	4	4	A	D	CO2		751	16	192.0	880	1	2	SM10	B	NON
76	4118	PSM24ALCO2	P	S	M	4	4	A	L	CO2		848	16	192.0	960	1	3	SM10	B	NON

HYDROGEN SULFIDE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
1	8302	FBB13ACH2S	F	B	B	1	3	A	C	H2S		243	239	5.08	54.0	1	1	BBFV	A	NON
2	8303	FBB13ADH2S	F	B	B	1	3	A	D	H2S		430	239	5.08	95.6	1	2	BBFV	A	NON
3	8305	FBB13ALH2S	F	B	B	1	3	A	L	H2S	<	242	239	5.08	53.7	1	3	BBFV	A	NON
4	8306	FBB13BCH2S	F	B	B	1	3	B	C	H2S	<	255	239	5.08	56.6	1	4	BBFV	A	NON
5	8307	FBB13BDH2S	F	B	B	1	3	B	D	H2S	<	230	239	5.08	51.0	1	5	BBFV	A	NON
6	8308	FBB13BLH2S	F	B	B	1	3	B	L	H2S	<	238	239	5.08	53.0	1	6	BBFV	A	NON
7	8309	FBB14ACH2S	F	B	B	1	4	A	C	H2S	<	291	424	10.00	44.3	1	1	BBFV	A	NON
8	8310	FBB14ADH2S	F	B	B	1	4	A	D	H2S	<	272	424	10.00	41.0	1	2	BBFV	A	NON
9	8312	FBB14ALH2S	F	B	B	1	4	A	L	H2S	<	396	424	10.00	59.8	1	3	BBFV	A	NON
10	8313	FBB14BCH2S	F	B	B	1	4	B	C	H2S	<	288	424	10.00	43.5	1	4	BBFV	A	NON
11	8314	FBB14BDH2S	F	B	B	1	4	B	D	H2S	<	353	424	10.00	70.6	1	5	BBFV	A	NON
12	8315	FBB14BLH2S	F	B	B	1	4	B	L	H2S	<	282	424	10.00	56.4	1	6	BBFV	A	NON
13	8317	FBB21ACH2S	F	B	B	2	1	A	C	H2S	<	193	467	12.75	41.4	1	1	BBFV	A	NON
14	8318	FBB21ADH2S	F	B	B	2	1	A	D	H2S	<	215	467	12.75	46.0	1	2	BBFV	A	NON
15	8320	FBB21ALH2S	F	B	B	2	1	A	L	H2S		171	467	12.75	36.6	1	3	BBFV	A	NON
16	8321	FBB21BCH2S	F	B	B	2	1	B	C	H2S	<	170	467	12.75	36.4	1	4	BBFV	A	NON
17	8322	FBB21BDH2S	F	B	B	2	1	B	D	H2S	<	174	467	12.75	37.4	1	5	BBFV	A	NON
18	8323	FBB21BLH2S	F	B	B	2	1	B	L	H2S	<	164	467	12.75	35.1	1	6	BBFV	A	NON
19	8324	FBB22ACH2S	F	B	B	2	2	A	C	H2S	<	238	463	12.35	46.7	1	1	BBFV	A	NON
20	8325	FBB22ADH2S	F	B	B	2	2	A	D	H2S	<	199	463	12.35	39.1	1	2	BBFV	A	NON
21	8327	FBB22ALH2S	F	B	B	2	2	A	L	H2S	<	252	463	12.35	49.5	1	3	BBFV	A	NON
22	8328	FBB22BCH2S	F	B	B	2	2	B	C	H2S	<	214	463	12.35	42.0	1	4	BBFV	A	NON
23	8329	FBB22BDH2S	F	B	B	2	2	B	D	H2S	<	390	463	12.35	76.5	1	5	BBFV	A	NON
24	8330	FBB22BLH2S	F	B	B	2	2	B	L	H2S	<	199	463	12.35	39.1	1	6	BBFV	A	NON
25	8333	FBB25ACH2S	F	B	B	2	5	A	C	H2S	<	161	382	11.53	107.0	1	1	BBFV	A	NON
26	8334	FBB25ADH2S	F	B	B	2	5	A	D	H2S		184	382	11.53	123.0	1	2	BBFV	A	NON
27	8336	FBB25ALH2S	F	B	B	2	5	A	L	H2S	<	152	382	11.53	101.0	1	3	BBFV	A	NON
28	8337	FBB25BCH2S	F	B	B	2	5	B	C	H2S	<	181	382	11.53	120.0	1	4	BBFV	A	NON
29	8338	FBB25BDH2S	F	B	B	2	5	B	D	H2S		190	382	11.53	127.0	1	5	BBFV	A	NON
30	8339	FBB25BLH2S	F	B	B	2	5	B	L	H2S	<	183	382	11.53	122.0	1	6	BBFV	A	NON
31	8502	FCT13ACH2S	F	C	T	1	3	A	C	H2S		701	160	58.50	146.0	1	1	CTAN	C	TANK
32	8503	FCT13ADH2S	F	C	T	1	3	A	D	H2S		448	160	58.50	95.3	1	2	CTAN	C	TANK
33	8505	FCT13ALH2S	F	C	T	1	3	A	L	H2S		1090	160	58.50	222.0	1	3	CTAN	C	TANK
34	8506	FCT13BCH2S	F	C	T	1	3	B	C	H2S		584	160	58.50	133.0	1	4	CTAN	C	TANK
35	8507	FCT13BDH2S	F	C	T	1	3	B	D	H2S		463	160	58.50	102.0	1	5	CTAN	C	TANK
36	8540	FCT13BGH2S	F	C	T	1	3	B	G	H2S	<	511	160	58.50	111.0	1	7	CTAN	C	TANK
37	8508	FCT13BLH2S	F	C	T	1	3	B	L	H2S		915	160	58.50	215.0	1	6	CTAN	C	TANK
38	8509	FCT14ACH2S	F	C	T	1	4	A	C	H2S	<	557	163	75.60	51.3	1	1	CTAN	C	TANK
39	8510	FCT14ADH2S	F	C	T	1	4	A	D	H2S	<	540	163	75.60	50.0	1	2	CTAN	C	TANK
40	8512	FCT14ALH2S	F	C	T	1	4	A	L	H2S	<	597	163	75.60	55.5	1	3	CTAN	C	TANK
41	8513	FCT14BCH2S	F	C	T	1	4	B	C	H2S	<	530	163	75.60	50.5	1	4	CTAN	C	TANK
42	8514	FCT14BDH2S	F	C	T	1	4	B	D	H2S		525	163	75.60	49.6	1	5	CTAN	C	TANK
43	8541	FCT14BGH2S	F	C	T	1	4	B	G	H2S		579	163	75.60	55.7	1	7	CTAN	C	TANK
44	8515	FCT14BLH2S	F	C	T	1	4	B	L	H2S	<	552	163	75.60	52.5	1	6	CTAN	C	TANK
45	8517	FCT21ACH2S	F	C	T	2	1	A	C	H2S		3220	162	69.90	1610.0	1	1	CTAN	C	TANK
46	8518	FCT21ADH2S	F	C	T	2	1	A	D	H2S		839	162	69.90	419.0	1	2	CTAN	C	TANK
47	8520	FCT21ALH2S	F	C	T	2	1	A	L	H2S		828	162	69.90	414.0	1	3	CTAN	C	TANK
48	8521	FCT21BCH2S	F	C	T	2	1	B	C	H2S		487	162	69.90	243.0	1	4	CTAN	C	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	8522	FCT21BDH2S	F	C	T	2	1	B	D	H2S		485.0	162	69.90	243.0	1	5	CTAN	C	TANK
50	8523	FCT21BLH2S	F	C	T	2	1	B	L	H2S	<	442.0	162	69.90	221.0	1	6	CTAN	C	TANK
51	8524	FCT22ACH2S	F	C	T	2	2	A	C	H2S		6120.0	166	92.70	1880.0	1	1	CTAN	C	TANK
52	8525	FCT22ADH2S	F	C	T	2	2	A	D	H2S		927.0	166	92.70	285.0	1	2	CTAN	C	TANK
53	8527	FCT22ALH2S	F	C	T	2	2	A	L	H2S		1070.0	166	92.70	330.0	1	3	CTAN	C	TANK
54	8528	FCT22BCH2S	F	C	T	2	2	B	C	H2S	<	520.0	166	92.70	160.0	1	4	CTAN	C	TANK
55	8529	FCT22BDH2S	F	C	T	2	2	B	D	H2S		440.0	166	92.70	135.0	1	5	CTAN	C	TANK
56	8543	FCT22BGH2S	F	C	T	2	2	B	G	H2S	<	676.0	166	92.70	208.0	1	7	CTAN	C	TANK
57	8530	FCT22BLH2S	F	C	T	2	2	B	L	H2S		2900.0	166	92.70	892.0	1	6	CTAN	C	TANK
58	8533	FCT25ACH2S	F	C	T	2	5	A	C	H2S		1830.0	160	58.50	141.0	1	1	CTAN	C	TANK
59	8534	FCT25ADH2S	F	C	T	2	5	A	D	H2S		530.0	160	58.50	40.8	1	2	CTAN	C	TANK
60	8536	FCT25ALH2S	F	C	T	2	5	A	L	H2S		480.0	160	58.50	36.9	1	3	CTAN	C	TANK
61	8602	FKA13ACH2S	F	K	A	1	3	A	C	H2S		70.7	272	126.15	51.5	1	1	KM1	E	TANK
62	8603	FKA13ADH2S	F	K	A	1	3	A	D	H2S	<	75.1	272	126.15	54.7	1	2	KM1	E	TANK
63	8605	FKA13ALH2S	F	K	A	1	3	A	L	H2S		131.0	272	126.15	95.1	1	3	KM1	E	TANK
64	8606	FKA13BCH2S	F	K	A	1	3	B	C	H2S		150.0	272	126.15	122.0	1	4	KM1	E	TANK
65	8607	FKA13BDH2S	F	K	A	1	3	B	D	H2S	<	73.3	272	126.15	59.5	1	5	KM1	E	TANK
66	8608	FKA13BGH2S	F	K	A	1	3	B	G	H2S	<	80.2	272	126.15	65.1	1	7	KM1	E	TANK
67	8609	FKA13BLH2S	F	K	A	1	3	B	L	H2S		77.1	272	126.15	62.6	1	6	KM1	E	TANK
68	8610	FKA14ACH2S	F	K	A	1	4	A	C	H2S		226.0	118	102.90	151.0	1	1	KM1	E	TANK
69	8611	FKA14ADH2S	F	K	A	1	4	A	D	H2S		111.0	118	102.90	74.5	1	2	KM1	E	TANK
70	8613	FKA14ALH2S	F	K	A	1	4	A	L	H2S		113.0	118	102.90	75.4	1	3	KM1	E	TANK
71	8614	FKA14BCH2S	F	K	A	1	4	B	C	H2S		113.0	118	102.90	75.4	1	4	KM1	E	TANK
72	8615	FKA14BDH2S	F	K	A	1	4	B	D	H2S	<	113.0	118	102.90	75.4	1	5	KM1	E	TANK
73	8616	FKA14BGH2S	F	K	A	1	4	B	G	H2S	<	113.0	118	102.90	75.4	1	7	KM1	E	TANK
74	8617	FKA14BLH2S	F	K	A	1	4	B	L	H2S		113.0	118	102.90	75.4	1	6	KM1	E	TANK
75	8619	FKA21ACH2S	F	K	A	2	1	A	C	H2S		105.0	178	160.05	74.6	1	1	KM1	E	TANK
76	8620	FKA21ADH2S	F	K	A	2	1	A	D	H2S	<	60.2	178	160.05	42.6	1	2	KM1	E	TANK
77	8622	FKA21ALH2S	F	K	A	2	1	A	L	H2S		64.9	178	160.05	45.9	1	3	KM1	E	TANK
78	8623	FKA21BCH2S	F	K	A	2	1	B	C	H2S		48.5	178	160.05	34.3	1	4	KM1	E	TANK
79	8624	FKA21BDH2S	F	K	A	2	1	B	D	H2S	<	54.1	178	160.05	38.2	1	5	KM1	E	TANK
80	8625	FKA21BGH2S	F	K	A	2	1	B	G	H2S		56.2	178	160.05	39.8	1	7	KM1	E	TANK
81	8626	FKA21BLH2S	F	K	A	2	1	B	L	H2S		60.2	178	160.05	42.6	1	6	KM1	E	TANK
82	8627	FKA22ACH2S	F	K	A	2	2	A	C	H2S	<	75.2	124	137.10	52.8	1	1	KM1	E	TANK
83	8628	FKA22ADH2S	F	K	A	2	2	A	D	H2S	<	77.3	124	137.10	54.3	1	2	KM1	E	TANK
84	8630	FKA22ALH2S	F	K	A	2	2	A	L	H2S	<	43.4	124	137.10	30.5	1	3	KM1	E	TANK
85	8631	FKA22BCH2S	F	K	A	2	2	B	C	H2S		108.0	124	137.10	76.2	1	4	KM1	E	TANK
86	8632	FKA22BDH2S	F	K	A	2	2	B	D	H2S		78.3	124	137.10	55.0	1	5	KM1	E	TANK
87	8633	FKA22BGH2S	F	K	A	2	2	B	G	H2S		64.8	124	137.10	45.5	1	7	KM1	E	TANK
88	8634	FKA22BLH2S	F	K	A	2	2	B	L	H2S	<	352.0	124	137.10	248.0	1	6	KM1	E	TANK
89	8702	FKT13ACH2S	F	K	T	1	3	A	C	H2S		45.8	331	177.60	36.2	1	1	KTAN	F	TANK
90	8703	FKT13ADH2S	F	K	T	1	3	A	D	H2S		44.4	331	177.60	35.1	1	2	KTAN	F	TANK
91	8705	FKT13ALH2S	F	K	T	1	3	A	L	H2S		46.1	331	177.60	36.9	1	3	KTAN	F	TANK
92	8706	FKT13BCH2S	F	K	T	1	3	B	C	H2S		43.6	331	177.60	36.2	1	4	KTAN	F	TANK
93	8707	FKT13BDH2S	F	K	T	1	3	B	D	H2S	<	44.7	331	177.60	36.5	1	5	KTAN	F	TANK
94	8708	FKT13BGH2S	F	K	T	1	3	B	G	H2S		88.8	331	177.60	72.0	1	7	KTAN	F	TANK
95	8709	FKT13BLH2S	F	K	T	1	3	B	L	H2S	<	49.4	331	177.60	39.9	1	6	KTAN	F	TANK
96	8710	FKT14ACH2S	F	K	T	1	4	A	C	H2S		67.0	577	155.55	52.5	1	1	KTAN	F	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
97	8711	FKT14ADH2S	F	K	T	1	4	A	D	H2S	<	37.5	577	155.55	29.0	1	2	KTAN	F	TANK
98	8713	FKT14ALH2S	F	K	T	1	4	A	L	H2S	<	30.8	577	155.55	24.1	1	3	KTAN	F	TANK
99	8714	FKT14BCH2S	F	K	T	1	4	B	C	H2S	<	36.3	577	155.55	29.3	1	4	KTAN	F	TANK
100	8715	FKT14BDH2S	F	K	T	1	4	B	D	H2S	<	31.8	577	155.55	25.6	1	5	KTAN	F	TANK
101	8716	FKT14BGH2S	F	K	T	1	4	B	G	H2S		28.2	577	155.55	22.7	1	7	KTAN	F	TANK
102	8717	FKT14BLH2S	F	K	T	1	4	B	L	H2S		27.5	577	155.55	22.1	1	6	KTAN	F	TANK
103	8202	FSM13ACH2S	F	S	M	1	3	A	C	H2S	<	208.0	12	144.00	86.1	1	1	SM10	B	NON
104	8203	FSM13ADH2S	F	S	M	1	3	A	D	H2S	<	276.0	12	144.00	114.0	1	2	SM10	B	NON
105	8205	FSM13ALH2S	F	S	M	1	3	A	L	H2S	<	224.0	12	144.00	92.9	1	3	SM10	B	NON
106	8206	FSM13BCH2S	F	S	M	1	3	B	C	H2S	<	197.0	12	144.00	81.7	1	4	SM10	B	NON
107	8207	FSM13BDH2S	F	S	M	1	3	B	D	H2S	<	197.0	12	144.00	81.7	1	5	SM10	B	NON
108	8208	FSM13BLH2S	F	S	M	1	3	B	L	H2S	<	197.0	12	144.00	81.7	1	6	SM10	B	NON
109	8209	FSM14ACH2S	F	S	M	1	4	A	C	H2S		259.0	16	192.00	59.0	1	1	SM10	B	NON
110	8210	FSM14ADH2S	F	S	M	1	4	A	D	H2S	<	334.0	16	192.00	78.5	1	2	SM10	B	NON
111	8212	FSM14ALH2S	F	S	M	1	4	A	L	H2S	<	334.0	16	192.00	78.5	1	3	SM10	B	NON
112	8213	FSM14BCH2S	F	S	M	1	4	B	C	H2S	<	208.0	16	192.00	52.5	1	4	SM10	B	NON
113	8214	FSM14BDH2S	F	S	M	1	4	B	D	H2S	<	362.0	16	192.00	90.6	1	5	SM10	B	NON
114	8215	FSM14BLH2S	F	S	M	1	4	B	L	H2S		601.0	16	192.00	153.0	1	6	SM10	B	NON
115	8217	FSM21ACH2S	F	S	M	2	1	A	C	H2S	<	182.0	10	120.00	102.0	1	1	SM10	B	NON
116	8218	FSM21ADH2S	F	S	M	2	1	A	D	H2S	<	151.0	10	120.00	77.1	1	2	SM10	B	NON
117	8220	FSM21ALH2S	F	S	M	2	1	A	L	H2S	<	158.0	10	120.00	84.3	1	3	SM10	B	NON
118	8221	FSM21BCH2S	F	S	M	2	1	B	C	H2S	<	180.0	10	120.00	87.6	1	4	SM10	B	NON
119	8222	FSM21BDH2S	F	S	M	2	1	B	D	H2S	<	155.0	10	120.00	75.7	1	5	SM10	B	NON
120	8223	FSM21BLH2S	F	S	M	2	1	B	L	H2S	<	158.0	10	120.00	77.0	1	6	SM10	B	NON
121	8224	FSM22ACH2S	F	S	M	2	2	A	C	H2S	<	195.0	8	96.00	104.0	1	1	SM10	B	NON
122	8225	FSM22ADH2S	F	S	M	2	2	A	D	H2S	<	195.0	8	96.00	104.0	1	2	SM10	B	NON
123	8227	FSM22ALH2S	F	S	M	2	2	A	L	H2S	<	195.0	8	96.00	104.0	1	3	SM10	B	NON
124	8228	FSM22BCH2S	F	S	M	2	2	B	C	H2S	<	176.0	8	96.00	101.0	1	4	SM10	B	NON
125	8229	FSM22BDH2S	F	S	M	2	2	B	D	H2S	<	176.0	8	96.00	101.0	1	5	SM10	B	NON
126	8230	FSM22BLH2S	F	S	M	2	2	B	L	H2S	<	204.0	8	96.00	117.0	1	6	SM10	B	NON
127	8233	FSM25ACH2S	F	S	M	2	5	A	C	H2S		158.0	8	96.00	81.8	1	1	SM10	B	NON
128	8234	FSM25ADH2S	F	S	M	2	5	A	D	H2S		168.0	8	96.00	85.6	1	2	SM10	B	NON
129	8237	FSM25BCH2S	F	S	M	2	5	B	C	H2S	<	187.0	8	96.00	127.0	1	4	SM10	B	NON
130	8238	FSM25BDH2S	F	S	M	2	5	B	D	H2S	<	188.0	8	96.00	127.0	1	5	SM10	B	NON
131	8102	PSM13ACH2S	P	S	M	3	3	A	C	H2S	<	247.0	16	192.00	76.9	1	1	SM10	B	NON
132	8103	PSM13ADH2S	P	S	M	3	3	A	D	H2S	<	221.0	16	192.00	67.8	1	2	SM10	B	NON
133	8104	PSM13ALH2S	P	S	M	3	3	A	L	H2S	<	321.0	16	192.00	97.9	1	3	SM10	B	NON
134	8106	PSM13BCH2S	P	S	M	3	3	B	C	H2S	<	301.0	16	192.00	143.0	1	4	SM10	B	NON
135	8107	PSM13BDH2S	P	S	M	3	3	B	D	H2S	<	608.0	16	192.00	279.0	1	5	SM10	B	NON
136	8108	PSM13BLH2S	P	S	M	3	3	B	L	H2S	<	664.0	16	192.00	303.0	1	6	SM10	B	NON
137	8109	PSM14ACH2S	P	S	M	3	4	A	C	H2S	<	209.0	16	192.00	67.1	1	1	SM10	B	NON
138	8110	PSM14ADH2S	P	S	M	3	4	A	D	H2S	<	277.0	16	192.00	85.7	1	2	SM10	B	NON
139	8111	PSM14ALH2S	P	S	M	3	4	A	L	H2S	<	278.0	16	192.00	89.4	1	3	SM10	B	NON
140	8113	PSM14BCH2S	P	S	M	3	4	B	C	H2S	<	69.5	16	192.00	33.8	1	4	SM10	B	NON
141	8114	PSM14BDH2S	P	S	M	3	4	B	D	H2S	<	210.0	16	192.00	101.0	1	5	SM10	B	NON
142	8115	PSM14BLH2S	P	S	M	3	4	B	L	H2S	<	102.0	16	192.00	50.4	1	6	SM10	B	NON
143	8116	PSM21ACH2S	P	S	M	4	1	A	C	H2S	<	399.0	16	192.00	277.0	1	1	SM10	B	NON
144	8117	PSM21ADH2S	P	S	M	4	1	A	D	H2S	<	258.0	16	192.00	178.0	1	2	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
145	8118	PSM21ALH2S	P	S	M	4	1	A	L	H2S	<	599.0	16	192	412.0	1	3	SM10	B	NON
146	8120	PSM21BCH2S	P	S	M	4	1	B	C	H2S	<	85.0	16	192	59.5	1	4	SM10	B	NON
147	8121	PSM21BDH2S	P	S	M	4	1	B	D	H2S	<	70.8	16	192	49.6	1	5	SM10	B	NON
148	8122	PSM21BLH2S	P	S	M	4	1	B	L	H2S	<	65.9	16	192	46.1	1	6	SM10	B	NON
149	8123	PSM22ACH2S	P	S	M	4	2	A	C	H2S	<	224.0	18	216	162.0	1	1	SM10	B	NON
150	8124	PSM22ADH2S	P	S	M	4	2	A	D	H2S	<	229.0	18	216	166.0	1	2	SM10	B	NON
151	8125	PSM22ALH2S	P	S	M	4	2	A	L	H2S	<	217.0	18	216	157.0	1	3	SM10	B	NON
152	8127	PSM22BCH2S	P	S	M	4	2	B	C	H2S	<	52.9	18	216	38.3	1	4	SM10	B	NON
153	8128	PSM22BDH2S	P	S	M	4	2	B	D	H2S	<	181.0	18	216	131.0	1	5	SM10	B	NON
154	8129	PSM22BLH2S	P	S	M	4	2	B	L	H2S	<	71.6	18	216	51.8	1	6	SM10	B	NON

HYDROGEN CYANIDE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
1	7302	FBB13ACHCN	F	B	B	1	3	A	C	HCN	<	360.0	239	5.082	79.9	1	1	BBFV	A	NON
2	7303	FBB13ADHCN	F	B	B	1	3	A	D	HCN	<	400.0	239	5.082	88.8	1	2	BBFV	A	NON
3	7305	FBB13ALHCN	F	B	B	1	3	A	L	HCN	<	398.0	239	5.082	88.3	1	3	BBFV	A	NON
4	7306	FBB14ACHCN	F	B	B	1	4	A	C	HCN	<	339.0	424	10.002	51.5	1	1	BBFV	A	NON
5	7307	FBB14ADHCN	F	B	B	1	4	A	D	HCN	<	365.0	424	10.002	55.1	1	2	BBFV	A	NON
6	7309	FBB14ALHCN	F	B	B	1	4	A	L	HCN	<	396.0	424	10.002	59.7	1	3	BBFV	A	NON
7	7315	FBB22ACHCN	F	B	B	2	2	A	C	HCN		411.0	463	12.350	80.6	1	1	BBFV	A	NON
8	7316	FBB22ADHCN	F	B	B	2	2	A	D	HCN		402.0	463	12.350	78.8	1	2	BBFV	A	NON
9	7318	FBB22ALHCN	F	B	B	2	2	A	L	HCN		494.0	463	12.350	96.9	1	3	BBFV	A	NON
10	7321	FBB25ACHCN	F	B	B	2	5	A	C	HCN	<	208.0	382	11.525	138.0	1	1	BBFV	A	NON
11	7322	FBB25ADHCN	F	B	B	2	5	A	D	HCN	<	193.0	382	11.525	129.0	1	2	BBFV	A	NON
12	7324	FBB25ALHCN	F	B	B	2	5	A	L	HCN	<	229.0	382	11.525	153.0	1	3	BBFV	A	NON
13	7502	FCT13ACHCN	F	C	T	1	3	A	C	HCN	<	1070.0	160	58.500	223.0	1	1	CTAN	C	TANK
14	7503	FCT13ADHCN	F	C	T	1	3	A	D	HCN	<	1080.0	160	58.500	230.0	1	2	CTAN	C	TANK
15	7505	FCT13ALHCN	F	C	T	1	3	A	L	HCN	<	1150.0	160	58.500	234.0	1	3	CTAN	C	TANK
16	7506	FCT14ACHCN	F	C	T	1	4	A	C	HCN	<	1120.0	163	75.600	103.0	1	1	CTAN	C	TANK
17	7507	FCT14ADHCN	F	C	T	1	4	A	D	HCN	<	1110.0	163	75.600	103.0	1	2	CTAN	C	TANK
18	7509	FCT14ALHCN	F	C	T	1	4	A	L	HCN	<	1190.0	163	75.600	110.0	1	3	CTAN	C	TANK
19	7511	FCT21ACHCN	F	C	T	2	1	A	C	HCN	<	1090.0	162	69.900	547.0	1	1	CTAN	C	TANK
20	7512	FCT21ADHCN	F	C	T	2	1	A	D	HCN	<	1170.0	162	69.900	583.0	1	2	CTAN	C	TANK
21	7514	FCT21ALHCN	F	C	T	2	1	A	L	HCN	<	951.0	162	69.900	476.0	1	3	CTAN	C	TANK
22	7515	FCT22ACHCN	F	C	T	2	2	A	C	HCN		701.0	166	92.700	216.0	1	1	CTAN	C	TANK
23	7516	FCT22ADHCN	F	C	T	2	2	A	D	HCN	<	1150.0	166	92.700	355.0	1	2	CTAN	C	TANK
24	7518	FCT22ALHCN	F	C	T	2	2	A	L	HCN	<	1070.0	166	92.700	330.0	1	3	CTAN	C	TANK
25	7602	FKA13ACHCN	F	K	A	1	3	A	C	HCN	<	207.0	272	126.150	151.0	1	1	KM1	E	TANK
26	7603	FKA13ADHCN	F	K	A	1	3	A	D	HCN	<	207.0	272	126.150	151.0	1	2	KM1	E	TANK
27	7605	FKA13ALHCN	F	K	A	1	3	A	L	HCN	<	207.0	272	126.150	151.0	1	3	KM1	E	TANK
28	7606	FKA14ACHCN	F	K	A	1	4	A	C	HCN	<	311.0	118	102.900	208.0	1	1	KM1	E	TANK
29	7608	FKA14ADHCN	F	K	A	1	4	A	D	HCN	<	311.0	118	102.900	208.0	1	2	KM1	E	TANK
30	7609	FKA14ALHCN	F	K	A	1	4	A	L	HCN	<	311.0	118	102.900	208.0	1	3	KM1	E	TANK
31	7611	FKA21ACHCN	F	K	A	2	1	A	C	HCN		1280.0	178	160.050	905.0	1	1	KM1	E	TANK
32	7612	FKA21ADHCN	F	K	A	2	1	A	D	HCN		919.0	178	160.050	650.0	1	2	KM1	E	TANK
33	7615	FKA22ACHCN	F	K	A	2	2	A	C	HCN		448.0	124	137.100	314.0	1	1	KM1	E	TANK
34	7616	FKA22ADHCN	F	K	A	2	2	A	D	HCN	<	599.0	124	137.100	420.0	1	2	KM1	E	TANK
35	7618	FKA22ALHCN	F	K	A	2	2	A	L	HCN	<	216.0	124	137.100	152.0	1	3	KM1	E	TANK
36	7624	FKA25ALHCN	F	K	A	2	5	A	L	HCN	<	146.0	77	154.150	103.0	1	3	KM1	E	TANK
37	7702	FKT13ACHCN	F	K	T	1	3	A	C	HCN	<	123.0	331	177.600	96.7	1	1	KTAN	F	TANK
38	7703	FKT13ADHCN	F	K	T	1	3	A	D	HCN	<	102.0	331	177.600	80.6	1	2	KTAN	F	TANK
39	7705	FKT13ALHCN	F	K	T	1	3	A	L	HCN		177.0	331	177.600	142.0	1	3	KTAN	F	TANK
40	7706	FKT14ACHCN	F	K	T	1	4	A	C	HCN		226.0	577	155.550	177.0	1	1	KTAN	F	TANK
41	7707	FKT14ADHCN	F	K	T	1	4	A	D	HCN		102.0	577	155.550	79.0	1	2	KTAN	F	TANK
42	7709	FKT14ALHCN	F	K	T	1	4	A	L	HCN		92.5	577	155.550	72.5	1	3	KTAN	F	TANK
43	7202	FSM13ACHCN	F	S	M	1	3	A	C	HCN	<	44.5	12	1.440	18.5	1	1	SM10	B	NON
44	7203	FSM13ADHCN	F	S	M	1	3	A	D	HCN	<	44.5	12	1.440	18.5	1	2	SM10	B	NON
45	7205	FSM13ALHCN	F	S	M	1	3	A	L	HCN	<	44.5	12	1.440	18.5	1	3	SM10	B	NON
46	7206	FSM14ACHCN	F	S	M	1	4	A	C	HCN		142.0	16	1.920	32.3	1	1	SM10	B	NON
47	7207	FSM14ADHCN	F	S	M	1	4	A	D	HCN		193.0	16	1.920	45.4	1	2	SM10	B	NON
48	7209	FSM14ALHCN	F	S	M	1	4	A	L	HCN		73.2	16	1.920	17.5	1	3	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	7211	FSM21ACHCN	F	S	M	2	1	A	C	HCN	<	112.0	10	1.20	62.8	1	1	SM10	B	NON
50	7212	FSM21ADHCN	F	S	M	2	1	A	D	HCN	<	112.0	10	1.20	57.1	1	2	SM10	B	NON
51	7214	FSM21ALHCN	F	S	M	2	1	A	L	HCN	<	112.0	10	1.20	59.8	1	3	SM10	B	NON
52	7221	FSM25ACHCN	F	S	M	2	5	A	C	HCN	<	190.0	8	0.96	98.0	1	1	SM10	B	NON
53	7222	FSM25ADHCN	F	S	M	2	5	A	D	HCN	<	187.0	8	0.96	95.0	1	2	SM10	B	NON
54	7224	FSM25ALHCN	F	S	M	2	5	A	L	HCN	<	182.0	8	0.96	111.0	1	3	SM10	B	NON
55	7102	PSM13ACHCN	P	S	M	3	3	A	C	HCN		96.6	16	1.92	30.0	1	1	SM10	B	NON
56	7103	PSM13ADHCN	P	S	M	3	3	A	D	HCN		82.6	16	1.92	25.3	1	2	SM10	B	NON
57	7104	PSM13ALHCN	P	S	M	3	3	A	L	HCN		94.7	16	1.92	28.8	1	3	SM10	B	NON
58	7106	PSM14ACHCN	P	S	M	3	4	A	C	HCN		89.1	16	1.92	28.5	1	1	SM10	B	NON
59	7107	PSM14ADHCN	P	S	M	3	4	A	D	HCN		122.0	16	1.92	37.4	1	2	SM10	B	NON
60	7108	PSM14ALHCN	P	S	M	3	4	A	L	HCN		92.8	16	1.92	29.8	1	3	SM10	B	NON
61	7110	PSM21ACHCN	P	S	M	4	1	A	C	HCN	<	108.0	16	1.92	74.7	1	1	SM10	B	NON
62	7111	PSM21ADHCN	P	S	M	4	1	A	D	HCN	<	81.6	16	1.92	56.3	1	2	SM10	B	NON
63	7112	PSM21ALHCN	P	S	M	4	1	A	L	HCN	<	108.0	16	1.92	74.3	1	3	SM10	B	NON
64	7114	PSM22ACHCN	P	S	M	4	2	A	C	HCN	<	75.2	18	2.16	54.5	1	1	SM10	B	NON
65	7115	PSM22ADHCN	P	S	M	4	2	A	D	HCN	<	90.9	18	2.16	65.8	1	2	SM10	B	NON
66	7116	PSM22ALHCN	P	S	M	4	2	A	L	HCN	<	78.6	18	2.16	56.9	1	3	SM10	B	NON

NITRIC OXIDE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VENNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFOR	VLOC	GROUP
1	10302	FBB13ACNO	F	B	B	1	3	A	C	NO		1810	239	5.082	402.0	1	1	BBFV	A	NON
2	10303	FBB13ADNO	F	B	B	1	3	A	D	NO	<	901	239	5.082	200.0	1	2	BBFV	A	NON
3	10305	FBB13ALNO	F	B	B	1	3	A	L	NO	<	1160	239	5.082	258.0	1	3	BBFV	A	NON
4	10306	FBB14ACNO	F	B	B	1	4	A	C	NO		3700	424	10.002	563.0	1	1	BBFV	A	NON
5	10307	FBB14ADNO	F	B	B	1	4	A	D	NO		1850	424	10.002	280.0	1	2	BBFV	A	NON
6	10309	FBB14ALNO	F	B	B	1	4	A	L	NO		2680	424	10.002	404.0	1	3	BBFV	A	NON
7	10311	FBB21ACNO	F	B	B	2	1	A	C	NO	<	662	467	12.750	142.0	1	1	BBFV	A	NON
8	10312	FBB21ADNO	F	B	B	2	1	A	D	NO		676	467	12.750	145.0	1	2	BBFV	A	NON
9	10314	FBB21ALNO	F	B	B	2	1	A	L	NO	<	851	467	12.750	182.0	1	3	BBFV	A	NON
10	10315	FBB22ACNO	F	B	B	2	2	A	C	NO	<	583	463	12.350	114.0	1	1	BBFV	A	NON
11	10316	FBB22ADNO	F	B	B	2	2	A	D	NO		490	463	12.350	96.1	1	2	BBFV	A	NON
12	10502	FCT13ACNO	F	C	T	1	3	A	C	NO		2920	160	58.500	609.0	1	1	CTAN	C	TANK
13	10503	FCT13ADNO	F	C	T	1	3	A	D	NO		3150	160	58.500	671.0	1	2	CTAN	C	TANK
14	10505	FCT13ALNO	F	C	T	1	3	A	L	NO		2370	160	58.500	483.0	1	3	CTAN	C	TANK
15	10506	FCT14ACNO	F	C	T	1	4	A	C	NO		2010	163	75.600	185.0	1	1	CTAN	C	TANK
16	10507	FCT14ADNO	F	C	T	1	4	A	D	NO		1740	163	75.600	162.0	1	2	CTAN	C	TANK
17	10509	FCT14ALNO	F	C	T	1	4	A	L	NO		1520	163	75.600	142.0	1	3	CTAN	C	TANK
18	10511	FCT21ACNO	F	C	T	2	1	A	C	NO		6430	162	69.900	3210.0	1	1	CTAN	C	TANK
19	10512	FCT21ADNO	F	C	T	2	1	A	D	NO		4120	162	69.900	2060.0	1	2	CTAN	C	TANK
20	10514	FCT21ALNO	F	C	T	2	1	A	L	NO		5440	162	69.900	2720.0	1	3	CTAN	C	TANK
21	10515	FCT22ACNO	F	C	T	2	2	A	C	NO		3090	166	92.700	950.0	1	1	CTAN	C	TANK
22	10516	FCT22ADNO	F	C	T	2	2	A	D	NO		4410	166	92.700	1360.0	1	2	CTAN	C	TANK
23	10518	FCT22ALNO	F	C	T	2	2	A	L	NO		1880	166	92.700	577.0	1	3	CTAN	C	TANK
24	10602	FKA13ACNO	F	K	A	1	3	A	C	NO	<	174	272	126.150	127.0	1	1	KM1	E	TANK
25	10603	FKA13ADNO	F	K	A	1	3	A	D	NO	<	163	272	126.150	118.0	1	2	KM1	E	TANK
26	10605	FKA13ALNO	F	K	A	1	3	A	L	NO		235	272	126.150	171.0	1	3	KM1	E	TANK
27	10606	FKA14ACNO	F	K	A	1	4	A	C	NO	<	366	118	102.900	245.0	1	1	KM1	E	TANK
28	10607	FKA14ADNO	F	K	A	1	4	A	D	NO	<	352	118	102.900	235.0	1	2	KM1	E	TANK
29	10609	FKA14ALNO	F	K	A	1	4	A	L	NO	<	366	118	102.900	245.0	1	3	KM1	E	TANK
30	10611	FKA21ACNO	F	K	A	2	1	A	C	NO	<	132	178	160.050	93.1	1	1	KM1	E	TANK
31	10612	FKA21ADNO	F	K	A	2	1	A	D	NO	<	107	178	160.050	75.7	1	2	KM1	E	TANK
32	10614	FKA21ALNO	F	K	A	2	1	A	L	NO	<	143	178	160.050	101.0	1	3	KM1	E	TANK
33	10615	FKA22ACNO	F	K	A	2	2	A	C	NO	<	347	124	137.100	244.0	1	1	KM1	E	TANK
34	10616	FKA22ADNO	F	K	A	2	2	A	D	NO	<	229	124	137.100	161.0	1	2	KM1	E	TANK
35	10618	FKA22ALNO	F	K	A	2	2	A	L	NO	<	153	124	137.100	107.0	1	3	KM1	E	TANK
36	10624	FKA25ALNO	F	K	A	2	5	A	L	NO	<	172	77	154.150	121.0	1	3	KM1	E	TANK
37	10702	FKT13ACNO	F	K	T	1	3	A	C	NO		240	331	177.600	189.0	1	1	KTAN	F	TANK
38	10703	FKT13ADNO	F	K	T	1	3	A	D	NO		222	331	177.600	176.0	1	2	KTAN	F	TANK
39	10705	FKT13ALNO	F	K	T	1	3	A	L	NO		312	331	177.600	250.0	1	3	KTAN	F	TANK
40	10706	FKT14ACNO	F	K	T	1	4	A	C	NO		254	577	155.550	199.0	1	1	KTAN	F	TANK
41	10707	FKT14ADNO	F	K	T	1	4	A	D	NO		208	577	155.550	161.0	1	2	KTAN	F	TANK
42	10709	FKT14ALNO	F	K	T	1	4	A	L	NO		248	577	155.550	194.0	1	3	KTAN	F	TANK
43	10203	FSM13ADNO	F	S	M	1	3	A	D	NO		217	12	1.440	90.0	1	2	SM10	B	NON
44	10205	FSM13ALNO	F	S	M	1	3	A	L	NO	<	273	12	1.440	113.0	1	3	SM10	B	NON
45	10209	FSM14ACNO	F	S	M	1	4	A	C	NO		920	16	1.920	209.0	1	1	SM10	B	NON
46	10210	FSM14ADNO	F	S	M	1	4	A	D	NO		802	16	1.920	189.0	1	2	SM10	B	NON
47	10212	FSM14ALNO	F	S	M	1	4	A	L	NO		1180	16	1.920	283.0	1	3	SM10	B	NON
48	10217	FSM21ACNO	F	S	M	2	1	A	C	NO	<	541	10	1.200	303.0	1	1	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIRECONC	IOTCAL	TOTMASS	TOICONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	10218	FSM21ADNO	F	S	M	2	1	A	D	NO	<	487.0	10	1.20	248.0	1	2	SM10	B	NON
50	10220	FSM21ALNO	F	S	M	2	1	A	L	NO	<	635.0	10	1.20	339.0	1	3	SM10	B	NON
51	10224	FSM22ACNO	F	S	M	2	2	A	C	NO	<	667.0	8	0.96	357.0	1	1	SM10	B	NON
52	10225	FSM22ADNO	F	S	M	2	2	A	D	NO	<	503.0	8	0.96	289.0	1	2	SM10	B	NON
53	10227	FSM22ALNO	F	S	M	2	2	A	L	NO	<	470.0	8	0.96	258.0	1	3	SM10	B	NON
54	10233	FSM25ACNO	F	S	M	2	5	A	C	NO	<	649.0	8	0.96	335.0	1	1	SM10	B	NON
55	10234	FSM25ADNO	F	S	M	2	5	A	D	NO	<	630.0	8	0.96	320.0	1	2	SM10	B	NON
56	10102	PSM13ACNO	P	S	M	3	3	A	C	NO		838.0	16	1.92	261.0	1	1	SM10	B	NON
57	10103	PSM13ADNO	P	S	M	3	3	A	D	NO	<	118.0	16	1.92	36.1	1	2	SM10	B	NON
58	10104	PSM13ALNO	P	S	M	3	3	A	L	NO		473.0	16	1.92	144.0	1	3	SM10	B	NON
59	10109	PSM14ACNO	P	S	M	3	4	A	C	NO		163.0	16	1.92	52.2	1	1	SM10	B	NON
60	10110	PSM14ADNO	P	S	M	3	4	A	D	NO		135.0	16	1.92	41.8	1	2	SM10	B	NON
61	10111	PSM14ALNO	P	S	M	3	4	A	L	NO		182.0	16	1.92	58.5	1	3	SM10	B	NON
62	10116	PSM21ACNO	P	S	M	4	1	A	C	NO		210.0	16	1.92	145.0	1	1	SM10	B	NON
63	10117	PSM21ADNO	P	S	M	4	1	A	D	NO		286.0	16	1.92	197.0	1	2	SM10	B	NON
64	10118	PSM21ALNO	P	S	M	4	1	A	L	NO		273.0	16	1.92	187.0	1	3	SM10	B	NON
65	10123	PSM22ACNO	P	S	M	4	2	A	C	NO	<	107.0	18	2.16	77.2	1	1	SM10	B	NON
66	10124	PSM22ADNO	P	S	M	4	2	A	D	NO	<	84.8	18	2.16	61.4	1	2	SM10	B	NON
67	10125	PSM22ALNO	P	S	M	4	2	A	L	NO	<	88.6	18	2.16	64.1	1	3	SM10	B	NON

NITROGEN DIOXIDE - GENERAL AREA

OBS	LAB NO	FLD CODE	SCALE	FORT	VEHTYP	DAY	VENNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIELDCONC	IOCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
1	10302	FBB13ACNO2	F	B	B	1	3	A	C	NO2		2240	239	5.082	498	1	1	BBFV	A	NON
2	10303	FBB13ADNO2	F	B	B	1	3	A	D	NO2	<	1320	239	5.082	307	1	2	BBFV	A	NON
3	10305	FBB13ALNO2	F	B	B	1	3	A	L	NO2	<	1780	239	5.082	395	1	3	BBFV	A	NON
4	10306	FBB14ACNO2	F	B	B	1	4	A	C	NO2		2100	424	10.002	320	1	1	BBFV	A	NON
5	10307	FBB14ADNO2	F	B	B	1	4	A	D	NO2		1190	424	10.002	180	1	2	BBFV	A	NON
6	10309	FBB14ALNO2	F	B	B	1	4	A	L	NO2		1310	424	10.002	198	1	3	BBFV	A	NON
7	10311	FBB21ACNO2	F	B	B	2	1	A	C	NO2		1160	467	12.750	250	1	1	BBFV	A	NON
8	10312	FBB21ADNO2	F	B	B	2	1	A	D	NO2	<	876	467	12.750	188	1	2	BBFV	A	NON
9	10314	FBB21ALNO2	F	B	B	2	1	A	L	NO2	<	1300	467	12.750	280	1	3	BBFV	A	NON
10	10315	FBB22ACNO2	F	B	B	2	2	A	C	NO2	<	894	463	12.350	175	1	1	BBFV	A	NON
11	10316	FBB22ADNO2	F	B	B	2	2	A	D	NO2	<	675	463	12.350	132	1	2	BBFV	A	NON
12	10502	FCT13ACNO2	F	C	T	1	3	A	C	NO2	<	2890	160	58.500	602	1	1	CTAN	C	TANK
13	10503	FCT13ADNO2	F	C	T	1	3	A	D	NO2		4290	160	58.500	913	1	2	CTAN	C	TANK
14	10505	FCT13ALNO2	F	C	T	1	3	A	L	NO2		5170	160	58.500	1060	1	3	CTAN	C	TANK
15	10506	FCT14ACNO2	F	C	T	1	4	A	C	NO2		1560	163	75.600	143	1	1	CTAN	C	TANK
16	10507	FCT14ADNO2	F	C	T	1	4	A	D	NO2		2130	163	75.600	198	1	2	CTAN	C	TANK
17	10509	FCT14ALNO2	F	C	T	1	4	A	L	NO2		2920	163	75.600	272	1	3	CTAN	C	TANK
18	10511	FCT21ACNO2	F	C	T	2	1	A	C	NO2		3550	162	69.900	1770	1	1	CTAN	C	TANK
19	10512	FCT21ADNO2	F	C	T	2	1	A	D	NO2		3090	162	69.900	1540	1	2	CTAN	C	TANK
20	10514	FCT21ALNO2	F	C	T	2	1	A	L	NO2		3380	162	69.900	1690	1	3	CTAN	C	TANK
21	10515	FCT22ACNO2	F	C	T	2	2	A	C	NO2		8430	166	92.700	2590	1	1	CTAN	C	TANK
22	10516	FCT22ADNO2	F	C	T	2	2	A	D	NO2		2820	166	92.700	868	1	2	CTAN	C	TANK
23	10518	FCT22ALNO2	F	C	T	2	2	A	L	NO2	<	2280	166	92.700	702	1	3	CTAN	C	TANK
24	10602	FKA13ACNO2	F	K	A	1	3	A	C	NO2	<	267	272	126.150	195	1	1	KM1	E	TANK
25	10603	FKA13ADNO2	F	K	A	1	3	A	D	NO2	<	249	272	126.150	182	1	2	KM1	E	TANK
26	10605	FKA13ALNO2	F	K	A	1	3	A	L	NO2	<	288	272	126.150	210	1	3	KM1	E	TANK
27	10606	FKA14ACNO2	F	K	A	1	4	A	C	NO2	<	561	118	102.900	375	1	1	KM1	E	TANK
28	10607	FKA14ADNO2	F	K	A	1	4	A	D	NO2	<	540	118	102.900	361	1	2	KM1	E	TANK
29	10609	FKA14ALNO2	F	K	A	1	4	A	L	NO2	<	561	118	102.900	375	1	3	KM1	E	TANK
30	10611	FKA21ACNO2	F	K	A	2	1	A	C	NO2	<	202	178	160.050	143	1	1	KM1	E	TANK
31	10612	FKA21ADNO2	F	K	A	2	1	A	D	NO2	<	164	178	160.050	116	1	2	KM1	E	TANK
32	10614	FKA21ALNO2	F	K	A	2	1	A	L	NO2	<	219	178	160.050	155	1	3	KM1	E	TANK
33	10615	FKA22ACNO2	F	K	A	2	2	A	C	NO2	<	532	124	137.100	373	1	1	KM1	E	TANK
34	10616	FKA22ADNO2	F	K	A	2	2	A	D	NO2	<	351	124	137.100	247	1	2	KM1	E	TANK
35	10618	FKA22ALNO2	F	K	A	2	2	A	L	NO2	<	234	124	137.100	164	1	3	KM1	E	TANK
36	10624	FKA25ALNO2	F	K	A	2	5	A	L	NO2	<	264	77	154.150	186	1	3	KM1	E	TANK
37	10702	FKT13ACNO2	F	K	T	1	3	A	C	NO2		348	331	177.600	275	1	1	KTAN	F	TANK
38	10703	FKT13ADNO2	F	K	T	1	3	A	D	NO2		424	331	177.600	335	1	2	KTAN	F	TANK
39	10705	FKT13ALNO2	F	K	T	1	3	A	L	NO2		466	331	177.600	372	1	3	KTAN	F	TANK
40	10706	FKT14ACNO2	F	K	T	1	4	A	C	NO2		458	577	155.550	359	1	1	KTAN	F	TANK
41	10707	FKT14ADNO2	F	K	T	1	4	A	D	NO2		461	577	155.550	357	1	2	KTAN	F	TANK
42	10709	FKT14ALNO2	F	K	T	1	4	A	L	NO2		494	577	155.550	387	1	3	KTAN	F	TANK
43	10203	FSM13ADNO2	F	S	M	1	3	A	D	NO2	<	309	12	1.440	128	1	2	SM10	B	NON
44	10205	FSM13ALNO2	F	S	M	1	3	A	L	NO2	<	418	12	1.440	173	1	3	SM10	B	NON
45	10209	FSM14ACNO2	F	S	M	1	4	A	C	NO2	<	731	16	1.920	166	1	1	SM10	B	NON
46	10210	FSM14ADNO2	F	S	M	1	4	A	D	NO2	<	603	16	1.920	142	1	2	SM10	B	NON
47	10212	FSM14ALNO2	F	S	M	1	4	A	L	NO2	<	596	16	1.920	143	1	3	SM10	B	NON
48	10217	FSM21ACNO2	F	S	M	2	1	A	C	NO2	<	829	10	1.200	464	1	1	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPARS	ANALYTE	BOLEAN	FIRECONC	IOICAL	TOTMASS	TOTCONC	SELECT	TREAT	VIYPIORT	VIOC	CROUP
49	10218	FSM21ADNO2	F	S	M	2	1	A	D	NO2	<	746	10	1.20	380.0	1	2	SM10	B	NON
50	10220	FSM21ALNO2	F	S	M	2	1	A	L	NO2	<	974	10	1.20	519.0	1	3	SM10	B	NON
51	10224	FSM22ACNO2	F	S	M	2	2	A	C	NO2	<	1020	8	0.96	547.0	1	1	SM10	B	NON
52	10225	FSM22ADNO2	F	S	M	2	2	A	D	NO2	<	772	8	0.96	443.0	1	2	SM10	B	NON
53	10227	FSM22ALNO2	F	S	M	2	2	A	L	NO2	<	720	8	0.96	395.0	1	3	SM10	B	NON
54	10233	FSM25ACNO2	F	S	M	2	5	A	C	NO2	<	995	8	0.96	514.0	1	1	SM10	B	NON
55	10234	FSM25ADNO2	F	S	M	2	5	A	D	NO2	<	965	8	0.96	491.0	1	2	SM10	B	NON
56	10102	PSM13ACNO2	P	S	M	3	3	A	C	NO2		918	16	1.92	286.0	1	1	SM10	B	NON
57	10103	PSM13ADNO2	P	S	M	3	3	A	D	NO2	<	180	16	1.92	55.3	1	2	SM10	B	NON
58	10104	PSM13ALNO2	P	S	M	3	3	A	L	NO2		865	16	1.92	264.0	1	3	SM10	B	NON
59	10109	PSM14ACNO2	P	S	M	3	4	A	C	NO2		345	16	1.92	111.0	1	1	SM10	B	NON
60	10110	PSM14ADNO2	P	S	M	3	4	A	D	NO2		255	16	1.92	78.9	1	2	SM10	B	NON
61	10111	PSM14ALNO2	P	S	M	3	4	A	L	NO2		362	16	1.92	116.0	1	3	SM10	B	NON
62	10116	PSM21ACNO2	P	S	M	4	1	A	C	NO2	<	189	16	1.92	131.0	1	1	SM10	B	NON
63	10117	PSM21ADNO2	P	S	M	4	1	A	D	NO2		279	16	1.92	192.0	1	2	SM10	B	NON
64	10118	PSM21ALNO2	P	S	M	4	1	A	L	NO2		549	16	1.92	377.0	1	3	SM10	B	NON
65	10123	PSM22ACNO2	P	S	M	4	2	A	C	NO2		245	18	2.16	178.0	1	1	SM10	B	NON
66	10124	PSM22ADNO2	P	S	M	4	2	A	D	NO2		195	18	2.16	141.0	1	2	SM10	B	NON
67	10125	PSM22ALNO2	P	S	M	4	2	A	L	NO2	<	136	18	2.16	98.3	1	3	SM10	B	NON

NITROGEN DIOXIDE - BREATHING ZONE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
1	20301	FBB13BDNO2	F	B	B	1	3	B	D	NO2	<	1010.0	239	5.08	225.0	1	5	BBFV	A	NON
2	20302	FBB13BLNO2	F	B	B	1	3	B	L	NO2		1340.0	239	5.08	297.0	1	6	BBFV	A	NON
3	20303	FBB14BCNO2	F	B	B	1	4	B	C	NO2		1280.0	424	10.00	194.0	1	4	BBFV	A	NON
4	20304	FBB14BDNO2	F	B	B	1	4	B	D	NO2		1160.0	424	10.00	176.0	1	5	BBFV	A	NON
5	20305	FBB14BLNO2	F	B	B	1	4	B	L	NO2		1340.0	424	10.00	203.0	1	6	BBFV	A	NON
6	20306	FBB21BCNO2	F	B	B	2	1	B	C	NO2		2530.0	467	12.75	543.0	1	4	BBFV	A	NON
7	20307	FBB21BDNO2	F	B	B	2	1	B	D	NO2		635.0	467	12.75	136.0	1	5	BBFV	A	NON
8	20308	FBB21BLNO2	F	B	B	2	1	B	L	NO2		773.0	467	12.75	166.0	1	6	BBFV	A	NON
9	20309	FBB22BCNO2	F	B	B	2	2	B	C	NO2		556.0	463	12.35	109.0	1	4	BBFV	A	NON
10	20310	FBB22BDNO2	F	B	B	2	2	B	D	NO2		912.0	463	12.35	179.0	1	5	BBFV	A	NON
11	20311	FBB22BLNO2	F	B	B	2	2	B	L	NO2		516.0	463	12.35	101.0	1	6	BBFV	A	NON
12	20312	FBB25BCNO2	F	B	B	2	5	B	C	NO2		674.0	382	11.53	450.0	1	4	BBFV	A	NON
13	20313	FBB25BDNO2	F	B	B	2	5	B	D	NO2		536.0	382	11.53	357.0	1	5	BBFV	A	NON
14	20314	FBB25BLNO2	F	B	B	2	5	B	L	NO2		497.0	382	11.53	331.0	1	6	BBFV	A	NON
15	20500	FCT13BCNO2	F	C	T	1	3	B	C	NO2		1780.0	160	58.50	372.0	1	4	CTAN	C	TANK
16	20501	FCT13BDNO2	F	C	T	1	3	B	D	NO2		2470.0	160	58.50	515.0	1	5	CTAN	C	TANK
17	20515	FCT13BGNO2	F	C	T	1	3	B	G	NO2		1970.0	160	58.50	411.0	1	7	CTAN	C	TANK
18	20502	FCT13BLNO2	F	C	T	1	3	B	L	NO2		2350.0	160	58.50	489.0	1	6	CTAN	C	TANK
19	20503	FCT14BCNO2	F	C	T	1	4	B	C	NO2		16300.0	163	75.60	1240.0	1	4	CTAN	C	TANK
20	20504	FCT14BDNO2	F	C	T	1	4	B	D	NO2		3090.0	163	75.60	235.0	1	5	CTAN	C	TANK
21	20516	FCT14BGNO2	F	C	T	1	4	B	G	NO2		3090.0	163	75.60	235.0	1	7	CTAN	C	TANK
22	20505	FCT14BLNO2	F	C	T	1	4	B	L	NO2		17900.0	163	75.60	1360.0	1	6	CTAN	C	TANK
23	20506	FCT21BCNO2	F	C	T	2	1	B	C	NO2		2780.0	162	69.90	1390.0	1	4	CTAN	C	TANK
24	20507	FCT21BDNO2	F	C	T	2	1	B	D	NO2		5090.0	162	69.90	2550.0	1	5	CTAN	C	TANK
25	20517	FCT21BGNO2	F	C	T	2	1	B	G	NO2		2410.0	162	69.90	1200.0	1	7	CTAN	C	TANK
26	20508	FCT21BLNO2	F	C	T	2	1	B	L	NO2		2970.0	162	69.90	1490.0	1	6	CTAN	C	TANK
27	20509	FCT22BCNO2	F	C	T	2	2	B	C	NO2		2720.0	166	92.70	837.0	1	4	CTAN	C	TANK
28	20510	FCT22BDNO2	F	C	T	2	2	B	D	NO2		3220.0	166	92.70	991.0	1	5	CTAN	C	TANK
29	20518	FCT22BGNO2	F	C	T	2	2	B	G	NO2		2220.0	166	92.70	683.0	1	7	CTAN	C	TANK
30	20511	FCT22BLNO2	F	C	T	2	2	B	L	NO2		4160.0	166	92.70	1280.0	1	6	CTAN	C	TANK
31	20600	FKA13BCNO2	F	K	A	1	3	B	C	NO2		160.0	272	126.15	117.0	1	4	KM1	E	TANK
32	20601	FKA13BDNO2	F	K	A	1	3	B	D	NO2		160.0	272	126.15	117.0	1	5	KM1	E	TANK
33	20602	FKA13BGNO2	F	K	A	1	3	B	G	NO2		428.0	272	126.15	311.0	1	7	KM1	E	TANK
34	20603	FKA13BLNO2	F	K	A	1	3	B	L	NO2		68.5	272	126.15	49.9	1	6	KM1	E	TANK
35	20604	FKA14BCNO2	F	K	A	1	4	B	C	NO2		89.4	118	102.90	59.8	1	4	KM1	E	TANK
36	20605	FKA14BDNO2	F	K	A	1	4	B	D	NO2		119.0	118	102.90	79.3	1	5	KM1	E	TANK
37	20606	FKA14BGNO2	F	K	A	1	4	B	G	NO2		79.8	118	102.90	53.4	1	7	KM1	E	TANK
38	20607	FKA14BLNO2	F	K	A	1	4	B	L	NO2		167.0	118	102.90	112.0	1	6	KM1	E	TANK
39	20608	FKA21BCNO2	F	K	A	2	1	B	C	NO2		83.2	178	160.05	58.8	1	4	KM1	E	TANK
40	20609	FKA21BDNO2	F	K	A	2	1	B	D	NO2		36.3	178	160.05	25.7	1	5	KM1	E	TANK
41	20610	FKA21BGNO2	F	K	A	2	1	B	G	NO2		228.0	178	160.05	161.0	1	7	KM1	E	TANK
42	20611	FKA21BLNO2	F	K	A	2	1	B	L	NO2		281.0	178	160.05	198.0	1	6	KM1	E	TANK
43	20612	FKA22BCNO2	F	K	A	2	2	B	C	NO2		303.0	124	137.10	213.0	1	4	KM1	E	TANK
44	20613	FKA22BDNO2	F	K	A	2	2	B	D	NO2		291.0	124	137.10	205.0	1	5	KM1	E	TANK
45	20614	FKA22BGNO2	F	K	A	2	2	B	G	NO2		23[illegible]0	124	137.10	166.0	1	7	KM1	E	TANK
46	20615	FKA22BLNO2	F	K	A	2	2	B	L	NO2		401.0	124	137.10	281.0	1	6	KM1	E	TANK
47	20700	FKT13BCNO2	F	K	T	1	3	B	C	NO2		281.0	331	177.60	221.0	1	4	KTAN	F	TANK
48	20701	FKT13BDNO2	F	K	T	1	3	B	D	NO2		77.5	331	177.60	61.1	1	5	KTAN	F	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	20702	FKT13BGNO2	F	K	T	1	3	B	G	NO2		802.0	331	177.60	633.0	1	7	KTAN	F	TANK
50	20703	FKT13BLNO2	F	K	T	1	3	B	L	NO2		135.0	331	177.60	106.0	1	6	KTAN	F	TANK
51	20704	FKT14BCNO2	F	K	T	1	4	B	C	NO2		289.0	577	155.55	227.0	1	4	KTAN	F	TANK
52	20705	FKT14BDNO2	F	K	T	1	4	B	D	NO2		375.0	577	155.55	294.0	1	5	KTAN	F	TANK
53	20706	FKT14BGNO2	F	K	T	1	4	B	G	NO2		271.0	577	155.55	212.0	1	7	KTAN	F	TANK
54	20707	FKT14BLNO2	F	K	T	1	4	B	L	NO2		196.0	577	155.55	154.0	1	6	KTAN	F	TANK
55	10206	FSM13BCNO2	F	S	M	1	3	B	C	NO2		228.0	12	144.00	94.6	1	4	SM10	B	NON
56	10207	FSM13BDNO2	F	S	M	1	3	B	D	NO2		329.0	12	144.00	136.0	1	5	SM10	B	NON
57	10208	FSM13BLNO2	F	S	M	1	3	B	L	NO2		203.0	12	144.00	84.1	1	6	SM10	B	NON
58	10213	FSM14BCNO2	F	S	M	1	4	B	C	NO2		467.0	16	192.00	106.0	1	4	SM10	B	NON
59	10214	FSM14BDNO2	F	S	M	1	4	B	D	NO2		452.0	16	192.00	103.0	1	5	SM10	B	NON
60	10215	FSM14BLNO2	F	S	M	1	4	B	L	NO2		482.0	16	192.00	110.0	1	6	SM10	B	NON
61	10221	FSM21BCNO2	F	S	M	2	1	B	C	NO2		214.0	10	120.00	120.0	1	4	SM10	B	NON
62	10222	FSM21BDNO2	F	S	M	2	1	B	D	NO2		617.0	10	120.00	345.0	1	5	SM10	B	NON
63	10223	FSM21BLNO2	F	S	M	2	1	B	L	NO2		341.0	10	120.00	191.0	1	6	SM10	B	NON
64	10228	FSM22BCNO2	F	S	M	2	2	B	C	NO2		366.0	8	96.00	195.0	1	4	SM10	B	NON
65	10229	FSM22BDNO2	F	S	M	2	2	B	D	NO2		538.0	8	96.00	287.0	1	5	SM10	B	NON
66	10230	FSM22BLNO2	F	S	M	2	2	B	L	NO2		289.0	8	96.00	154.0	1	6	SM10	B	NON
67	10237	FSM25BCNO2	F	S	M	2	5	B	C	NO2		449.0	8	96.00	228.0	1	4	SM10	B	NON
68	10238	FSM25BDNO2	F	S	M	2	5	B	D	NO2		469.0	8	96.00	238.0	1	5	SM10	B	NON
69	10239	FSM25BLNO2	F	S	M	2	5	B	L	NO2		430.0	8	96.00	218.0	1	6	SM10	B	NON
70	10106	PSM13BCNO2	P	S	M	3	3	B	C	NO2		487.0	16	192.00	152.0	1	4	SM10	B	NON
71	10107	PSM13BDNO2	P	S	M	3	3	B	D	NO2		131.0	16	192.00	40.9	1	5	SM10	B	NON
72	10108	PSM13BLNO2	P	S	M	3	3	B	L	NO2		92.8	16	192.00	28.9	1	6	SM10	B	NON
73	10113	PSM14BCNO2	P	S	M	3	4	B	C	NO2		63.4	16	192.00	20.2	1	4	SM10	B	NON
74	10114	PSM14BDNO2	P	S	M	3	4	B	D	NO2		82.4	16	192.00	26.2	1	5	SM10	B	NON
75	10115	PSM14BLNO2	P	S	M	3	4	B	L	NO2		92.1	16	192.00	29.3	1	6	SM10	B	NON
76	10120	PSM21BCNO2	P	S	M	4	1	B	C	NO2		65.5	16	192.00	45.8	1	4	SM10	B	NON
77	10121	PSM21BDNO2	P	S	M	4	1	B	D	NO2		99.7	16	192.00	69.8	1	5	SM10	B	NON
78	10122	PSM21BLNO2	P	S	M	4	1	B	L	NO2		143.0	16	192.00	99.9	1	6	SM10	B	NON
79	10127	PSM22BCNO2	P	S	M	4	2	B	C	NO2		63.3	18	216.00	45.8	1	4	SM10	B	NON
80	10128	PSM22BDNO2	P	S	M	4	2	B	D	NO2		96.5	18	216.00	69.8	1	5	SM10	B	NON
81	10129	PSM22BLNO2	P	S	M	4	2	B	L	NO2		55.1	18	216.00	39.9	1	6	SM10	B	NON

FORMALDEHYDE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
1	6302	FBB13ACFOR	F	B	B	1	3	A	C	FOR	<	99.5	239	5.08	22.1	1	1	BBFV	A	NON
2	6303	FBB13ADFOR	F	B	B	1	3	A	D	FOR	<	87.2	239	5.08	19.4	1	2	BBFV	A	NON
3	6305	FBB13ALFOR	F	B	B	1	3	A	L	FOR	<	87.9	239	5.08	19.5	1	3	BBFV	A	NON
4	6306	FBB13BCFOR	F	B	B	1	3	B	C	FOR	<	96.9	239	5.08	21.5	1	4	BBFV	A	NON
5	6307	FBB13BDFOR	F	B	B	1	3	B	D	FOR	<	80.4	239	5.08	17.9	1	5	BBFV	A	NON
6	6308	FBB13BLFOR	F	B	B	1	3	B	L	FOR	<	95.2	239	5.08	21.2	1	6	BBFV	A	NON
7	6309	FBB14ACFOR	F	B	B	1	4	A	C	FOR		182.0	424	10.00	27.7	1	1	BBFV	A	NON
8	6310	FBB14ADFOR	F	B	B	1	4	A	D	FOR		181.0	424	10.00	27.3	1	2	BBFV	A	NON
9	6312	FBB14ALFOR	F	B	B	1	4	A	L	FOR		308.0	424	10.00	46.5	1	3	BBFV	A	NON
10	6313	FBB14BCFOR	F	B	B	1	4	B	C	FOR		258.0	424	10.00	38.9	1	4	BBFV	A	NON
11	6314	FBB14BDFOR	F	B	B	1	4	B	D	FOR		93.4	424	10.00	18.7	1	5	BBFV	A	NON
12	6315	FBB14BLFOR	F	B	B	1	4	B	L	FOR		144.0	424	10.00	28.8	1	6	BBFV	A	NON
13	6317	FBB21ACFOR	F	B	B	2	1	A	C	FOR	<	67.3	467	12.75	14.4	1	1	BBFV	A	NON
14	6318	FBB21ADFOR	F	B	B	2	1	A	D	FOR	<	60.9	467	12.75	13.0	1	2	BBFV	A	NON
15	6320	FBB21ALFOR	F	B	B	2	1	A	L	FOR		82.1	467	12.75	17.6	1	3	BBFV	A	NON
16	6321	FBB21BCFOR	F	B	B	2	1	B	C	FOR		81.4	467	12.75	17.4	1	4	BBFV	A	NON
17	6322	FBB21BDFOR	F	B	B	2	1	B	D	FOR		109.0	467	12.75	23.3	1	5	BBFV	A	NON
18	6323	FBB21BLFOR	F	B	B	2	1	B	L	FOR		94.3	467	12.75	20.2	1	6	BBFV	A	NON
19	6324	FBB22ACFOR	F	B	B	2	2	A	C	FOR		92.2	463	12.35	18.1	1	1	BBFV	A	NON
20	6325	FBB22ADFOR	F	B	B	2	2	A	D	FOR		151.0	463	12.35	29.6	1	2	BBFV	A	NON
21	6327	FBB22ALFOR	F	B	B	2	2	A	L	FOR		155.0	463	12.35	30.3	1	3	BBFV	A	NON
22	6328	FBB22BCFOR	F	B	B	2	2	B	C	FOR		73.2	463	12.35	14.4	1	4	BBFV	A	NON
23	6329	FBB22BDFOR	F	B	B	2	2	B	D	FOR		130.0	463	12.35	25.6	1	5	BBFV	A	NON
24	6330	FBB22BLFOR	F	B	B	2	2	B	L	FOR		139.0	463	12.35	27.3	1	6	BBFV	A	NON
25	6502	FCT13ACFOR	F	C	T	1	3	A	C	FOR	<	474.0	160	58.50	98.7	1	1	CTAN	C	TANK
26	6503	FCT13ADFOR	F	C	T	1	3	A	D	FOR	<	434.0	160	58.50	92.3	1	2	CTAN	C	TANK
27	6505	FCT13ALFOR	F	C	T	1	3	A	L	FOR	<	450.0	160	58.50	91.8	1	3	CTAN	C	TANK
28	6506	FCT13BCFOR	F	C	T	1	3	B	C	FOR	<	494.0	160	58.50	112.0	1	4	CTAN	C	TANK
29	6507	FCT13BDFOR	F	C	T	1	3	B	D	FOR	<	483.0	160	58.50	106.0	1	5	CTAN	C	TANK
30	6508	FCT13BLFOR	F	C	T	1	3	B	L	FOR	<	499.0	160	58.50	118.0	1	6	CTAN	C	TANK
31	6509	FCT14ACFOR	F	C	T	1	4	A	C	FOR	<	361.0	163	75.60	33.2	1	1	CTAN	C	TANK
32	6510	FCT14ADFOR	F	C	T	1	4	A	D	FOR	<	335.0	163	75.60	31.0	1	2	CTAN	C	TANK
33	6512	FCT14ALFOR	F	C	T	1	4	A	L	FOR	<	345.0	163	75.60	32.1	1	3	CTAN	C	TANK
34	6513	FCT14BCFOR	F	C	T	1	4	B	C	FOR	<	374.0	163	75.60	35.6	1	4	CTAN	C	TANK
35	6514	FCT14BDFOR	F	C	T	1	4	B	D	FOR	<	370.0	163	75.60	34.9	1	5	CTAN	C	TANK
36	6541	FCT14BGFOR	F	C	T	1	4	B	G	FOR	<	335.0	163	75.60	32.2	1	7	CTAN	C	TANK
37	6515	FCT14BLFOR	F	C	T	1	4	B	L	FOR	<	356.0	163	75.60	34.0	1	6	CTAN	C	TANK
38	6517	FCT21ACFOR	F	C	T	2	1	A	C	FOR	<	415.0	162	69.90	208.0	1	1	CTAN	C	TANK
39	6518	FCT21ADFOR	F	C	T	2	1	A	D	FOR	<	399.0	162	69.90	199.0	1	2	CTAN	C	TANK
40	6520	FCT21ALFOR	F	C	T	2	1	A	L	FOR	<	399.0	162	69.90	199.0	1	3	CTAN	C	TANK
41	6521	FCT21BCFOR	F	C	T	2	1	B	C	FOR	<	458.0	162	69.90	229.0	1	4	CTAN	C	TANK
42	6522	FCT21BDFOR	F	C	T	2	1	B	D	FOR	<	410.0	162	69.90	205.0	1	5	CTAN	C	TANK
43	6542	FCT21BGFOR	F	C	T	2	1	B	G	FOR	<	391.0	162	69.90	196.0	1	7	CTAN	C	TANK
44	6524	FCT22ACFOR	F	C	T	2	2	A	C	FOR	<	388.0	166	92.70	119.0	1	1	CTAN	C	TANK
45	6525	FCT22ADFOR	F	C	T	2	2	A	D	FOR	<	284.0	166	92.70	87.4	1	2	CTAN	C	TANK
46	6527	FCT22ALFOR	F	C	T	2	2	A	L	FOR	<	363.0	166	92.70	112.0	1	3	CTAN	C	TANK
47	6529	FCT22BDFOR	F	C	T	2	2	B	D	FOR	<	322.0	166	92.70	99.1	1	5	CTAN	C	TANK
48	6530	FCT22BLFOR	F	C	T	2	2	B	L	FOR	<	370.0	166	92.70	114.0	1	6	CTAN	C	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIRECONC	TOTAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	6533	FCT25ACFOR	F	C	T	2	5	A	C	FOR		309.0	160	58.50	23.80	1	1	CTAN	C	TANK
50	6534	FCT25ADFOR	F	C	T	2	5	A	D	FOR	<	290.0	160	58.50	22.30	1	2	CTAN	C	TANK
51	6536	FCT25ALFOR	F	C	T	2	5	A	L	FOR		397.0	160	58.50	30.60	1	3	CTAN	C	TANK
52	6602	FKA13ACFOR	F	K	A	1	3	A	C	FOR		68.1	272	126.15	49.60	1	1	KM1	E	TANK
53	6603	FKA13ADFOR	F	K	A	1	3	A	D	FOR		55.5	272	126.15	40.40	1	2	KM1	E	TANK
54	6605	FKA13ALFOR	F	K	A	1	3	A	L	FOR	<	27.5	272	126.15	20.00	1	3	KM1	E	TANK
55	6606	FKA13BCFOR	F	K	A	1	3	B	C	FOR	<	27.5	272	126.15	22.30	1	4	KM1	E	TANK
56	6607	FKA13BDFOR	F	K	A	1	3	B	D	FOR		28.3	272	126.15	23.00	1	5	KM1	E	TANK
57	6608	FKA13BGFOR	F	K	A	1	3	B	G	FOR		29.4	272	126.15	23.90	1	7	KM1	E	TANK
58	6609	FKA13BLFOR	F	K	A	1	3	B	L	FOR	<	25.7	272	126.15	20.80	1	6	KM1	E	TANK
59	6610	FKA14ACFOR	F	K	A	1	4	A	C	FOR	<	41.8	118	102.90	28.00	1	1	KM1	E	TANK
60	6611	FKA14ADFOR	F	K	A	1	4	A	D	FOR		69.0	118	102.90	46.20	1	2	KM1	E	TANK
61	6613	FKA14ALFOR	F	K	A	1	4	A	L	FOR	<	41.3	118	102.90	27.60	1	3	KM1	E	TANK
62	6614	FKA14BCFOR	F	K	A	1	4	B	C	FOR	<	41.3	118	102.90	27.60	1	4	KM1	E	TANK
63	6615	FKA14BDFOR	F	K	A	1	4	B	D	FOR	<	41.3	118	102.90	27.60	1	5	KM1	E	TANK
64	6616	FKA14BGFOR	F	K	A	1	4	B	G	FOR	<	41.3	118	102.90	27.60	1	7	KM1	E	TANK
65	6617	FKA14BLFOR	F	K	A	1	4	B	L	FOR		88.4	118	102.90	59.10	1	6	KM1	E	TANK
66	6619	FKA21ACFOR	F	K	A	2	1	A	C	FOR		47.3	178	160.05	33.40	1	1	KM1	E	TANK
67	6620	FKA21ADFOR	F	K	A	2	1	A	D	FOR		46.8	178	160.05	33.10	1	2	KM1	E	TANK
68	6622	FKA21ALFOR	F	K	A	2	1	A	L	FOR		24.2	178	160.05	17.10	1	3	KM1	E	TANK
69	6623	FKA21BCFOR	F	K	A	2	1	B	C	FOR		57.9	178	160.05	40.90	1	4	KM1	E	TANK
70	6624	FKA21BDFOR	F	K	A	2	1	B	D	FOR		29.3	178	160.05	20.70	1	5	KM1	E	TANK
71	6625	FKA21BGFOR	F	K	A	2	1	B	G	FOR		33.2	178	160.05	23.50	1	7	KM1	E	TANK
72	6626	FKA21BLFOR	F	K	A	2	1	B	L	FOR		42.3	178	160.05	30.00	1	6	KM1	E	TANK
73	6627	FKA22ACFOR	F	K	A	2	2	A	C	FOR		51.5	124	137.10	36.10	1	1	KM1	E	TANK
74	6628	FKA22ADFOR	F	K	A	2	2	A	D	FOR		80.7	124	137.10	56.60	1	2	KM1	E	TANK
75	6630	FKA22ALFOR	F	K	A	2	2	A	L	FOR		20.3	124	137.10	14.20	1	3	KM1	E	TANK
76	6631	FKA22BCFOR	F	K	A	2	2	B	C	FOR		74.7	124	137.10	52.50	1	4	KM1	E	TANK
77	6632	FKA22BDFOR	F	K	A	2	2	B	D	FOR		44.8	124	137.10	31.50	1	5	KM1	E	TANK
78	6633	FKA22BGFOR	F	K	A	2	2	B	G	FOR		49.6	124	137.10	34.80	1	7	KM1	E	TANK
79	6634	FKA22BLFOR	F	K	A	2	2	B	L	FOR		54.2	124	137.10	38.00	1	6	KM1	E	TANK
80	6640	FKA25ALFOR	F	K	A	2	5	A	L	FOR		30.9	132	147.00	21.70	1	3	KM1	E	TANK
81	6702	FKT13ACFOR	F	K	T	1	3	A	C	FOR		41.7	331	177.60	32.90	1	1	KTAN	F	TANK
82	6703	FKT13ADFOR	F	K	T	1	3	A	D	FOR		32.5	331	177.60	25.60	1	2	KTAN	F	TANK
83	6705	FKT13ALFOR	F	K	T	1	3	A	L	FOR		36.5	331	177.60	29.20	1	3	KTAN	F	TANK
84	6706	FKT13BCFOR	F	K	T	1	3	B	C	FOR		30.5	331	177.60	25.30	1	4	KTAN	F	TANK
85	6707	FKT13BDFOR	F	K	T	1	3	B	D	FOR		46.9	331	177.60	38.30	1	5	KTAN	F	TANK
86	6708	FKT13BGFOR	F	K	T	1	3	B	G	FOR		39.4	331	177.60	32.00	1	7	KTAN	F	TANK
87	6709	FKT13BLFOR	F	K	T	1	3	B	L	FOR		56.3	331	177.60	45.60	1	6	KTAN	F	TANK
88	6710	FKT14ACFOR	F	K	T	1	4	A	C	FOR		57.6	577	155.55	45.20	1	1	KTAN	F	TANK
89	6711	FKT14ADFOR	F	K	T	1	4	A	D	FOR		103.0	577	155.55	79.50	1	2	KTAN	F	TANK
90	6713	FKT14ALFOR	F	K	T	1	4	A	L	FOR		72.2	577	155.55	56.60	1	3	KTAN	F	TANK
91	6714	FKT14BCFOR	F	K	T	1	4	B	C	FOR		60.4	577	155.55	48.70	1	4	KTAN	F	TANK
92	6715	FKT14BDFOR	F	K	T	1	4	B	D	FOR		71.0	577	155.55	57.20	1	5	KTAN	F	TANK
93	6716	FKT14BGFOR	F	K	T	1	4	B	G	FOR		63.5	577	155.55	51.20	1	7	KTAN	F	TANK
94	6717	FKT14BLFOR	F	K	T	1	4	B	L	FOR		57.4	577	155.55	46.30	1	6	KTAN	F	TANK
95	6202	FSM13ACFOR	F	S	M	1	3	A	C	FOR	<	22.8	12	144.00	9.47	1	1	SM10	B	NON
96	6203	FSM13ADFOR	F	S	M	1	3	A	D	FOR		27.7	12	144.00	11.50	1	2	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFOR	VLOC	GROUP
97	6205	FSM13ALFOR	F	S	M	1	3	A	L	FOR	<	22.80	12	144	9.47	1	3	SM10	B	NON
98	6206	FSM13BCFOR	F	S	M	1	3	B	C	FOR	<	23.20	12	144	9.63	1	4	SM10	B	NON
99	6207	FSM13BDFOR	F	S	M	1	3	B	D	FOR	<	24.50	12	144	10.20	1	5	SM10	B	NON
100	6208	FSM13BLFOR	F	S	M	1	3	B	L	FOR	<	23.80	12	144	9.88	1	6	SM10	B	NON
101	6209	FSM14ACFOR	F	S	M	1	4	A	C	FOR	<	44.40	16	192	10.10	1	1	SM10	B	NON
102	6210	FSM14ADFOR	F	S	M	1	4	A	D	FOR	<	41.40	16	192	9.74	1	2	SM10	B	NON
103	6212	FSM14ALFOR	F	S	M	1	4	A	L	FOR	<	45.70	16	192	10.90	1	3	SM10	B	NON
104	6213	FSM14BCFOR	F	S	M	1	4	B	C	FOR	<	41.30	16	192	10.50	1	4	SM10	B	NON
105	6214	FSM14BDFOR	F	S	M	1	4	B	D	FOR	<	45.10	16	192	11.30	1	5	SM10	B	NON
106	6215	FSM14BLFOR	F	S	M	1	4	B	L	FOR	<	31.90	16	192	8.10	1	6	SM10	B	NON
107	6217	FSM21ACFOR	F	S	M	2	1	A	C	FOR	<	60.00	10	120	33.60	1	1	SM10	B	NON
108	6218	FSM21ADFOR	F	S	M	2	1	A	D	FOR	<	76.80	10	120	39.10	1	2	SM10	B	NON
109	6220	FSM21ALFOR	F	S	M	2	1	A	L	FOR	<	61.10	10	120	32.60	1	3	SM10	B	NON
110	6221	FSM21BCFOR	F	S	M	2	1	B	C	FOR	<	64.50	10	120	31.40	1	4	SM10	B	NON
111	6222	FSM21BDFOR	F	S	M	2	1	B	D	FOR	<	71.90	10	120	35.00	1	5	SM10	B	NON
112	6223	FSM21BLFOR	F	S	M	2	1	B	L	FOR	<	65.80	10	120	32.00	1	6	SM10	B	NON
113	6224	FSM22ACFOR	F	S	M	2	2	A	C	FOR	<	57.20	8	96	30.60	1	1	SM10	B	NON
114	6225	FSM22ADFOR	F	S	M	2	2	A	D	FOR	<	53.90	8	96	31.00	1	2	SM10	B	NON
115	6227	FSM22ALFOR	F	S	M	2	2	A	L	FOR	<	57.60	8	96	31.60	1	3	SM10	B	NON
116	6228	FSM22BCFOR	F	S	M	2	2	B	C	FOR	<	54.60	8	96	31.30	1	4	SM10	B	NON
117	6229	FSM22BDFOR	F	S	M	2	2	B	D	FOR	<	58.60	8	96	34.30	1	5	SM10	B	NON
118	6230	FSM22BLFOR	F	S	M	2	2	B	L	FOR	<	49.40	8	96	28.30	1	6	SM10	B	NON
119	6102	PSM13ACFOR	P	S	M	3	3	A	C	FOR	<	24.30	16	192	7.55	1	1	SM10	B	NON
120	6103	PSM13ADFOR	P	S	M	3	3	A	D	FOR	<	26.00	16	192	7.96	1	2	SM10	B	NON
121	6104	PSM13ALFOR	P	S	M	3	3	A	L	FOR	<	26.50	16	192	8.08	1	3	SM10	B	NON
122	6106	PSM13BCFOR	P	S	M	3	3	B	C	FOR	<	15.90	16	192	7.57	1	4	SM10	B	NON
123	6107	PSM13BDFOR	P	S	M	3	3	B	D	FOR	<	35.00	16	192	16.10	1	5	SM10	B	NON
124	6108	PSM13BLFOR	P	S	M	3	3	B	L	FOR	<	39.80	16	192	18.20	1	6	SM10	B	NON
125	6109	PSM14ACFOR	P	S	M	3	4	A	C	FOR	<	26.30	16	192	8.45	1	1	SM10	B	NON
126	6110	PSM14ADFOR	P	S	M	3	4	A	D	FOR	<	25.90	16	192	8.02	1	2	SM10	B	NON
127	6111	PSM14ALFOR	P	S	M	3	4	A	L	FOR	<	26.10	16	192	8.39	1	3	SM10	B	NON
128	6113	PSM14BCFOR	P	S	M	3	4	B	C	FOR	<	38.60	16	192	18.80	1	4	SM10	B	NON
129	6114	PSM14BDFOR	P	S	M	3	4	B	D	FOR	<	26.40	16	192	12.70	1	5	SM10	B	NON
130	6115	PSM14BLFOR	P	S	M	3	4	B	L	FOR	<	21.90	16	192	10.80	1	6	SM10	B	NON
131	6116	PSM21ACFOR	P	S	M	4	1	A	C	FOR	<	21.90	16	192	15.20	1	1	SM10	B	NON
132	6117	PSM21ADFOR	P	S	M	4	1	A	D	FOR	<	28.50	16	192	19.70	1	2	SM10	B	NON
133	6118	PSM21ALFOR	P	S	M	4	1	A	L	FOR	<	40.50	16	192	27.80	1	3	SM10	B	NON
134	6120	PSM21BCFOR	P	S	M	4	1	B	C	FOR	<	8.88	16	192	6.22	1	4	SM10	B	NON
135	6121	PSM21BDFOR	P	S	M	4	1	B	D	FOR	<	26.60	16	192	18.60	1	5	SM10	B	NON
136	6122	PSM21BLFOR	P	S	M	4	1	B	L	FOR	<	25.10	16	192	17.60	1	6	SM10	B	NON
137	6123	PSM22ACFOR	P	S	M	4	2	A	C	FOR	<	23.30	18	216	16.80	1	1	SM10	B	NON
138	6124	PSM22ADFOR	P	S	M	4	2	A	D	FOR	<	20.80	18	216	15.10	1	2	SM10	B	NON
139	6125	PSM22ALFOR	P	S	M	4	2	A	L	FOR	<	20.80	18	216	15.10	1	3	SM10	B	NON
140	6127	PSM22BCFOR	P	S	M	4	2	B	C	FOR	<	20.40	18	216	14.80	1	4	SM10	B	NON
141	6128	PSM22BDFOR	P	S	M	4	2	B	D	FOR	<	23.60	18	216	17.10	1	5	SM10	B	NON
142	6129	PSM22BLFOR	P	S	M	4	2	B	L	FOR	<	19.70	18	216	14.30	1	6	SM10	B	NON

This page intentionally blank.

AMMONIA

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFOR	VLOC	GROUP
1	2300	FBB11ACNH3	F	B	B	1	1	A	C	NH3	<	358.0	490	10.2	89.6	1	1	BBFV	A	NON
2	2301	FBB11ADNH3	F	B	B	1	1	A	D	NH3	<	302.0	490	10.2	75.5	1	2	BBFV	A	NON
3	2303	FBB11ALNH3	F	B	B	1	1	A	L	NH3	<	306.0	490	10.2	76.5	1	3	BBFV	A	NON
4	2304	FBB12ACNH3	F	B	B	1	2	A	C	NH3	<	355.0	411	10.0	71.3	1	1	BBFV	A	NON
5	2305	FBB12ADNH3	F	B	B	1	2	A	D	NH3	<	365.0	411	10.0	73.3	1	2	BBFV	A	NON
6	2307	FBB12ALNH3	F	B	B	1	2	A	L	NH3	<	298.0	411	10.0	60.0	1	3	BBFV	A	NON
7	2310	FBB15ACNH3	F	B	B	1	5	A	C	NH3		759.0	487	13.1	169.0	1	1	BBFV	A	NON
8	2311	FBB15ADNH3	F	B	B	1	5	A	D	NH3	<	319.0	487	13.1	70.8	1	2	BBFV	A	NON
9	2313	FBB15ALNH3	F	B	B	1	5	A	L	NH3	<	290.0	487	13.1	64.5	1	3	BBFV	A	NON
10	2316	FBB23ACNH3	F	B	B	2	3	A	C	NH3		520.0	206	6.1	102.0	1	1	BBFV	A	NON
11	2317	FBB23ADNH3	F	B	B	2	3	A	D	NH3		418.0	206	6.1	86.5	1	2	BBFV	A	NON
12	2319	FBB23ALNH3	F	B	B	2	3	A	L	NH3		329.0	206	6.1	68.0	1	3	BBFV	A	NON
13	2320	FBB24ACNH3	F	B	B	2	4	A	C	NH3	<	267.0	329	12.0	72.8	1	1	BBFV	A	NON
14	2321	FBB24ADNH3	F	B	B	2	4	A	D	NH3		308.0	329	12.0	83.2	1	2	BBFV	A	NON
15	2323	FBB24ALNH3	F	B	B	2	4	A	L	NH3	<	250.0	329	12.0	68.9	1	3	BBFV	A	NON
16	2400	FCM11ACNH3	F	C	M	1	1	A	C	NH3		319.0	12	144.0	87.8	1	1	CM10	D	NON
17	2401	FCM11ADNH3	F	C	M	1	1	A	D	NH3	<	87.1	12	144.0	24.0	1	2	CM10	D	NON
18	2403	FCM11ALNH3	F	C	M	1	1	A	L	NH3		148.0	12	144.0	40.8	1	3	CM10	D	NON
19	2404	FCM12ACNH3	F	C	M	1	2	A	C	NH3	<	74.8	2	24.0	23.6	1	1	CM10	D	NON
20	2405	FCM12ADNH3	F	C	M	1	2	A	D	NH3	<	75.8	2	24.0	23.4	1	2	CM10	D	NON
21	2407	FCM12ALNH3	F	C	M	1	2	A	L	NH3	<	78.8	2	24.0	24.7	1	3	CM10	D	NON
22	2500	FCT11ACNH3	F	C	T	1	1	A	C	NH3		506.0	161	64.2	102.0	1	1	CTAN	C	TANK
23	2501	FCT11ADNH3	F	C	T	1	1	A	D	NH3		420.0	161	64.2	86.6	1	2	CTAN	C	TANK
24	2503	FCT11ALNH3	F	C	T	1	1	A	L	NH3		871.0	161	64.2	180.0	1	3	CTAN	C	TANK
25	2504	FCT12ACNH3	F	C	T	1	2	A	C	NH3		1680.0	117	69.5	299.0	1	1	CTAN	C	TANK
26	2505	FCT12ADNH3	F	C	T	1	2	A	D	NH3	<	353.0	117	69.5	60.8	1	2	CTAN	C	TANK
27	2507	FCT12ALNH3	F	C	T	1	2	A	L	NH3	<	387.0	117	69.5	65.0	1	3	CTAN	C	TANK
28	2516	FCT23ACNH3	F	C	T	2	3	A	C	NH3		574.0	161	64.2	60.5	1	1	CTAN	C	TANK
29	2517	FCT23ADNH3	F	C	T	2	3	A	D	NH3	<	328.0	161	64.2	34.5	1	2	CTAN	C	TANK
30	2519	FCT23ALNH3	F	C	T	2	3	A	L	NH3	<	275.0	161	64.2	28.9	1	3	CTAN	C	TANK
31	2520	FCT24ACNH3	F	C	T	2	4	A	C	NH3	<	474.0	156	35.7	36.5	1	1	CTAN	C	TANK
32	2521	FCT24ADNH3	F	C	T	2	4	A	D	NH3	<	328.0	156	35.7	25.2	1	2	CTAN	C	TANK
33	2523	FCT24ALNH3	F	C	T	2	4	A	L	NH3	<	342.0	156	35.7	26.3	1	3	CTAN	C	TANK
34	2600	FKA11ACNH3	F	K	A	1	1	A	C	NH3		486.0	215	86.1	392.0	1	1	KM1	E	TANK
35	2601	FKA11ADNH3	F	K	A	1	1	A	D	NH3		291.0	215	86.1	235.0	1	2	KM1	E	TANK
36	2603	FKA11ALNH3	F	K	A	1	1	A	L	NH3		599.0	215	86.1	483.0	1	3	KM1	E	TANK
37	2604	FKA12ACNH3	F	K	A	1	2	A	C	NH3		854.0	51	119.8	564.0	1	1	KM1	E	TANK
38	2605	FKA12ADNH3	F	K	A	1	2	A	D	NH3		77.3	51	119.8	51.1	1	2	KM1	E	TANK
39	2607	FKA12ALNH3	F	K	A	1	2	A	L	NH3		506.0	51	119.8	335.0	1	3	KM1	E	TANK
40	2610	FKA15ACNH3	F	K	A	1	5	A	C	NH3		243.0	51	119.8	160.0	1	1	KM1	E	TANK
41	2613	FKA15ALNH3	F	K	A	1	5	A	L	NH3		267.0	121	120.0	202.0	1	3	KM1	E	TANK
42	2616	FKA23ACNH3	F	K	A	2	3	A	C	NH3		825.0	125	142.8	697.0	1	1	KM1	E	TANK
43	2617	FKA23ADNH3	F	K	A	2	3	A	D	NH3		152.0	125	142.8	129.0	1	2	KM1	E	TANK
44	2619	FKA23ALNH3	F	K	A	2	3	A	L	NH3		607.0	125	142.8	512.0	1	3	KM1	E	TANK
45	2620	FKA24ACNH3	F	K	A	2	4	A	C	NH3		402.0	30	171.0	344.0	1	1	KM1	E	TANK
46	2621	FKA24ADNH3	F	K	A	2	4	A	D	NH3		148.0	30	171.0	126.0	1	2	KM1	E	TANK
47	2623	FKA24ALNH3	F	K	A	2	4	A	L	NH3		384.0	30	171.0	329.0	1	3	KM1	E	TANK
48	2700	FKT11ACNH3	F	K	T	1	1	A	C	NH3		194.0	552	155.5	150.0	1	1	KTAN	F	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFOR	VLOC	GROUP
49	2701	FKT11ADNH3	F	K	T	1	1	A	D	NH3		118.0	552	155.5	91.0	1	2	KTAN	F	TANK
50	2703	FKT11ALNH3	F	K	T	1	1	A	L	NH3		407.0	552	155.5	315.0	1	3	KTAN	F	TANK
51	2704	FKT12ACNH3	F	K	T	1	2	A	C	NH3		795.0	327	154.8	650.0	1	1	KTAN	F	TANK
52	2705	FKT12ADNH3	F	K	T	1	2	A	D	NH3		136.0	327	154.8	110.0	1	2	KTAN	F	TANK
53	2707	FKT12ALNH3	F	K	T	1	2	A	L	NH3		1010.0	327	154.8	836.0	1	3	KTAN	F	TANK
54	2200	FSM11ACNH3	F	S	M	1	1	A	C	NH3	<	203.0	7	84.0	72.5	1	1	SM10	B	NON
55	2201	FSM11ADNH3	F	S	M	1	1	A	D	NH3	<	186.0	7	84.0	68.7	1	2	SM10	B	NON
56	2203	FSM11ALNH3	F	S	M	1	1	A	L	NH3	<	106.0	7	84.0	38.6	1	3	SM10	B	NON
57	2204	FSM12ACNH3	F	S	M	1	2	A	C	NH3	<	128.0	12	144.0	47.0	1	1	SM10	B	NON
58	2205	FSM12ADNH3	F	S	M	1	2	A	D	NH3	<	652.0	12	144.0	232.0	1	2	SM10	B	NON
59	2207	FSM12ALNH3	F	S	M	1	2	A	L	NH3	<	234.0	12	144.0	82.7	1	3	SM10	B	NON
60	2210	FSM15ACNH3	F	S	M	1	5	A	C	NH3	<	132.0	13	156.0	47.4	1	1	SM10	B	NON
61	2211	FSM15ADNH3	F	S	M	1	5	A	D	NH3	<	115.0	13	156.0	41.2	1	2	SM10	B	NON
62	2213	FSM15ALNH3	F	S	M	1	5	A	L	NH3	<	396.0	13	156.0	142.0	1	3	SM10	B	NON
63	2216	FSM23ACNH3	F	S	M	2	3	A	C	NH3	<	488.0	10	120.0	264.0	1	1	SM10	B	NON
64	2217	FSM23ADNH3	F	S	M	2	3	A	D	NH3	<	215.0	10	120.0	116.0	1	2	SM10	B	NON
65	2219	FSM23ALNH3	F	S	M	2	3	A	L	NH3	<	321.0	10	120.0	176.0	1	3	SM10	B	NON
66	2220	FSM24ACNH3	F	S	M	2	4	A	C	NH3	<	469.0	10	120.0	174.0	1	1	SM10	B	NON
67	2221	FSM24ADNH3	F	S	M	2	4	A	D	NH3	<	517.0	10	120.0	298.0	1	2	SM10	B	NON
68	2223	FSM24ALNH3	F	S	M	2	4	A	L	NH3	<	247.0	10	120.0	91.4	1	3	SM10	B	NON
69	2100	PSM11ACNH3	P	S	M	3	1	A	C	NH3	<	82.4	12	144.0	31.8	1	1	SM10	B	NON
70	2101	PSM11ADNH3	P	S	M	3	1	A	D	NH3	<	83.5	12	144.0	32.1	1	2	SM10	B	NON
71	2102	PSM11ALNH3	P	S	M	3	1	A	L	NH3	<	81.0	12	144.0	30.8	1	3	SM10	B	NON
72	2104	PSM12ACNH3	P	S	M	3	2	A	C	NH3	<	161.0	16	192.0	62.9	1	1	SM10	B	NON
73	2105	PSM12ADNH3	P	S	M	3	2	A	D	NH3	<	69.2	16	192.0	26.5	1	2	SM10	B	NON
74	2106	PSM12ALNH3	P	S	M	3	2	A	L	NH3	<	83.3	16	192.0	32.1	1	3	SM10	B	NON
75	2110	PSM21ALNH3	P	S	M	4	1	A	L	NH3	<	83.3	16	192.0	32.1	1	3	SM10	B	NON
76	2112	PSM23ACNH3	P	S	M	4	3	A	C	NH3	<	146.0	17	204.0	92.0	1	1	SM10	B	NON
77	2113	PSM23ADNH3	P	S	M	4	3	A	D	NH3	<	127.0	17	204.0	79.6	1	2	SM10	B	NON
78	2114	PSM23ALNH3	P	S	M	4	3	A	L	NH3	<	126.0	17	204.0	79.3	1	3	SM10	B	NON
79	2116	PSM24ACNH3	P	S	M	4	4	A	C	NH3	<	77.4	16	192.0	57.5	1	1	SM10	B	NON
80	2117	PSM24ADNH3	P	S	M	4	4	A	D	NH3	<	310.0	16	192.0	227.0	1	2	SM10	B	NON
81	2118	PSM24ALNH3	P	S	M	4	4	A	L	NH3	<	64.5	16	192.0	47.9	1	3	SM10	B	NON

SULFUR DIOXIDE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPARSN	ANALYTE	BOLEAN	FIRECONC	TOTCAL	TOTMASS	TOICONC	SELECT	TREAT	VTYPFOR	VLOC	GROUP
1	15300	FBB11ACSO2	F	B	B	1	1	A	C	SO2	<	360	490	10.20	90.0	1	1	BBFV	A	NON
2	15301	FBB11ADSO2	F	B	B	1	1	A	D	SO2	<	313	490	10.20	78.3	1	2	BBFV	A	NON
3	15303	FBB11ALSO2	F	B	B	1	1	A	L	SO2	<	363	490	10.20	90.6	1	3	BBFV	A	NON
4	15304	FBB11BCSO2	F	B	B	1	1	B	C	SO2	<	364	490	10.20	90.9	1	4	BBFV	A	NON
5	15305	FBB11BDSO2	F	B	B	1	1	B	D	SO2	<	350	490	10.20	63.3	1	5	BBFV	A	NON
6	15306	FBB11BLSO2	F	B	B	1	1	B	L	SO2	<	351	490	10.20	63.5	1	6	BBFV	A	NON
7	15307	FBB12ACSO2	F	B	B	1	2	A	C	SO2	<	380	411	9.96	76.3	1	1	BBFV	A	NON
8	15308	FBB12ADSO2	F	B	B	1	2	A	D	SO2	<	373	411	9.96	75.0	1	2	BBFV	A	NON
9	15310	FBB12ALSO2	F	B	B	1	2	A	L	SO2	<	360	411	9.96	72.3	1	3	BBFV	A	NON
10	15311	FBB12BCSO2	F	B	B	1	2	B	C	SO2	<	334	411	9.96	67.1	1	4	BBFV	A	NON
11	15312	FBB12BDSO2	F	B	B	1	2	B	D	SO2	<	310	411	9.96	62.2	1	5	BBFV	A	NON
12	15313	FBB12BLSO2	F	B	B	1	2	B	L	SO2	<	313	411	9.96	63.0	1	6	BBFV	A	NON
13	15316	FBB15ACSO2	F	B	B	1	5	A	C	SO2		497	487	13.10	111.0	1	1	BBFV	A	NON
14	15317	FBB15ADSO2	F	B	B	1	5	A	D	SO2	<	424	487	13.10	94.3	1	2	BBFV	A	NON
15	15319	FBB15ALSO2	F	B	B	1	5	A	L	SO2		419	487	13.10	93.1	1	3	BBFV	A	NON
16	15320	FBB15BCSO2	F	B	B	1	5	B	C	SO2		565	487	13.10	126.0	1	4	BBFV	A	NON
17	15321	FBB15BDSO2	F	B	B	1	5	B	D	SO2	<	395	487	13.10	87.8	1	5	BBFV	A	NON
18	15322	FBB15BLSO2	F	B	B	1	5	B	L	SO2		441	487	13.10	98.1	1	6	BBFV	A	NON
19	15325	FBB23ACSO2	F	B	B	2	3	A	C	SO2	<	240	206	6.05	49.7	1	1	BBFV	A	NON
20	15326	FBB23ADSO2	F	B	B	2	3	A	D	SO2	<	207	206	6.05	42.8	1	2	BBFV	A	NON
21	15328	FBB23ALSO2	F	B	B	2	3	A	L	SO2	<	235	206	6.05	48.5	1	3	BBFV	A	NON
22	15329	FBB23BCSO2	F	B	B	2	3	B	C	SO2	<	237	206	6.05	49.0	1	4	BBFV	A	NON
23	15330	FBB23BDSO2	F	B	B	2	3	B	D	SO2	<	226	206	6.05	46.7	1	5	BBFV	A	NON
24	15332	FBB24ACSO2	F	B	B	2	4	A	C	SO2	<	259	329	12.05	70.7	1	1	BBFV	A	NON
25	15333	FBB24ADSO2	F	B	B	2	4	A	D	SO2	<	252	329	12.05	68.1	1	2	BBFV	A	NON
26	15335	FBB24ALSO2	F	B	B	2	4	A	L	SO2	<	259	329	12.05	71.3	1	3	BBFV	A	NON
27	15336	FBB24BCSO2	F	B	B	2	4	B	C	SO2	<	251	329	12.05	68.4	1	4	BBFV	A	NON
28	15337	FBB24BDSO2	F	B	B	2	4	B	D	SO2	<	225	329	12.05	61.4	1	5	BBFV	A	NON
29	15400	FCM11ACSO2	F	C	M	1	1	A	C	SO2	<	209	12	144.00	57.3	1	1	CM10	D	NON
30	15401	FCM11ADSO2	F	C	M	1	1	A	D	SO2	<	194	12	144.00	53.2	1	2	CM10	D	NON
31	15403	FCM11ALSO2	F	C	M	1	1	A	L	SO2	<	214	12	144.00	58.8	1	3	CM10	D	NON
32	15404	FCM11BCSO2	F	C	M	1	1	B	C	SO2	<	227	12	144.00	66.6	1	4	CM10	D	NON
33	15405	FCM11BDSO2	F	C	M	1	1	B	D	SO2	<	215	12	144.00	63.1	1	5	CM10	D	NON
34	15407	FCM11BLSO2	F	C	M	1	1	B	L	SO2	<	207	12	144.00	60.7	1	6	CM10	D	NON
35	15408	FCM12ACSO2	F	C	M	1	2	A	C	SO2	<	189	2	24.00	59.6	1	1	CM10	D	NON
36	15409	FCM12ADSO2	F	C	M	1	2	A	D	SO2	<	192	2	24.00	59.4	1	2	CM10	D	NON
37	15411	FCM12ALSO2	F	C	M	1	2	A	L	SO2	<	169	2	24.00	53.0	1	3	CM10	D	NON
38	15412	FCM12BCSO2	F	C	M	1	2	B	C	SO2	<	192	2	24.00	60.7	1	4	CM10	D	NON
39	15413	FCM12BDSO2	F	C	M	1	2	B	D	SO2	<	165	2	24.00	54.1	1	5	CM10	D	NON
40	15415	FCM12BLSO2	F	C	M	1	2	B	L	SO2	<	172	2	24.00	55.2	1	6	CM10	D	NON
41	15500	FCT11ACSO2	F	C	T	1	1	A	C	SO2	<	760	161	64.20	154.0	1	1	CTAN	C	TANK
42	15501	FCT11ADSO2	F	C	T	1	1	A	D	SO2	<	730	161	64.20	150.0	1	2	CTAN	C	TANK
43	15503	FCT11ALSO2	F	C	T	1	1	A	L	SO2	<	811	161	64.20	167.0	1	3	CTAN	C	TANK
44	15504	FCT11BCSO2	F	C	T	1	1	B	C	SO2	<	905	161	64.20	201.0	1	4	CTAN	C	TANK
45	15505	FCT11BDSO2	F	C	T	1	1	B	D	SO2	<	705	161	64.20	153.0	1	5	CTAN	C	TANK
46	15540	FCT11BGSO2	F	C	T	1	1	B	G	SO2	<	743	161	64.20	177.0	1	7	CTAN	C	TANK
47	15506	FCT11BLSO2	F	C	T	1	1	B	L	SO2	<	934	161	64.20	205.0	1	6	CTAN	C	TANK
48	15507	FCT12ACSO2	F	C	T	1	2	A	C	SO2	<	761	117	69.45	136.0	1	1	CTAN	C	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	15508	FCT12ADSO2	F	C	T	1	2	A	D	SO2	<	770.0	117	69.45	133.0	1	2	CTAN	C	TANK
50	15510	FCT12ALSO2	F	C	T	1	2	A	L	SO2	<	820.0	117	69.45	138.0	1	3	CTAN	C	TANK
51	15511	FCT12BCSO2	F	C	T	1	2	B	C	SO2	<	713.0	117	69.45	126.0	1	4	CTAN	C	TANK
52	15512	FCT12BDSO2	F	C	T	1	2	B	D	SO2	<	719.0	117	69.45	127.0	1	5	CTAN	C	TANK
53	15541	FCT12BGSO2	F	C	T	1	2	B	G	SO2	<	701.0	117	69.45	124.0	1	7	CTAN	C	TANK
54	15513	FCT12BLSO2	F	C	T	1	2	B	L	SO2	<	669.0	117	69.45	124.0	1	6	CTAN	C	TANK
55	15516	FCT15ACSO2	F	C	T	1	5	A	C	SO2	<	584.0	156	35.70	156.0	1	1	CTAN	C	TANK
56	15517	FCT15ADSO2	F	C	T	1	5	A	D	SO2	<	592.0	156	35.70	158.0	1	2	CTAN	C	TANK
57	15519	FCT15ALSO2	F	C	T	1	5	A	L	SO2	<	555.0	156	35.70	148.0	1	3	CTAN	C	TANK
58	15525	FCT23ACSO2	F	C	T	2	3	A	C	SO2	<	826.0	161	64.20	86.9	1	1	CTAN	C	TANK
59	15528	FCT23ALSO2	F	C	T	2	3	A	L	SO2	<	735.0	161	64.20	77.4	1	3	CTAN	C	TANK
60	15529	FCT23BCSO2	F	C	T	2	3	B	C	SO2	<	821.0	161	64.20	86.4	1	4	CTAN	C	TANK
61	15530	FCT23BDSO2	F	C	T	2	3	B	D	SO2	<	619.0	161	64.20	65.2	1	5	CTAN	C	TANK
62	15542	FCT23BGSO2	F	C	T	2	3	B	G	SO2	<	652.0	161	64.20	68.6	1	7	CTAN	C	TANK
63	15531	FCT23BLSO2	F	C	T	2	3	B	L	SO2	<	737.0	161	64.20	77.6	1	6	CTAN	C	TANK
64	15532	FCT24ACSO2	F	C	T	2	4	A	C	SO2	<	761.0	156	35.70	58.6	1	1	CTAN	C	TANK
65	15533	FCT24ADSO2	F	C	T	2	4	A	D	SO2	<	914.0	156	35.70	70.3	1	2	CTAN	C	TANK
66	15535	FCT24ALSO2	F	C	T	2	4	A	L	SO2	<	732.0	156	35.70	56.3	1	3	CTAN	C	TANK
67	15536	FCT24BCSO2	F	C	T	2	4	B	C	SO2	<	742.0	156	35.70	57.1	1	4	CTAN	C	TANK
68	15600	FKA11ACSO2	F	K	A	1	1	A	C	SO2	<	124.0	215	86.10	99.6	1	1	KM1	E	TANK
69	15601	FKA11ADSO2	F	K	A	1	1	A	D	SO2	<	124.0	215	86.10	99.6	1	2	KM1	E	TANK
70	15603	FKA11ALSO2	F	K	A	1	1	A	L	SO2	<	128.0	215	86.10	103.0	1	3	KM1	E	TANK
71	15604	FKA11BCSO2	F	K	A	1	1	B	C	SO2	<	124.0	215	86.10	99.6	1	4	KM1	E	TANK
72	15605	FKA11BDSO2	F	K	A	1	1	B	D	SO2	<	134.0	215	86.10	108.0	1	5	KM1	E	TANK
73	15606	FKA11BGSO2	F	K	A	1	1	B	G	SO2	<	124.0	215	86.10	99.6	1	7	KM1	E	TANK
74	15607	FKA11BLSO2	F	K	A	1	1	B	L	SO2	<	128.0	215	86.10	103.0	1	6	KM1	E	TANK
75	15608	FKA12ACSO2	F	K	A	1	2	A	C	SO2	<	135.0	51	119.79	89.0	1	1	KM1	E	TANK
76	15609	FKA12ADSO2	F	K	A	1	2	A	D	SO2	<	132.0	51	119.79	87.2	1	2	KM1	E	TANK
77	15611	FKA12ALSO2	F	K	A	1	2	A	L	SO2	<	142.0	51	119.79	94.0	1	3	KM1	E	TANK
78	15612	FKA12BCSO2	F	K	A	1	2	B	C	SO2	<	143.0	51	119.79	94.4	1	4	KM1	E	TANK
79	15614	FKA12BGSO2	F	K	A	1	2	B	G	SO2	<	143.0	51	119.79	94.4	1	7	KM1	E	TANK
80	15615	FKA12BLSO2	F	K	A	1	2	B	L	SO2	<	143.0	51	119.79	94.4	1	6	KM1	E	TANK
81	15624	FKA23ACSO2	F	K	A	2	3	A	C	SO2	<	85.3	125	142.80	72.1	1	1	KM1	E	TANK
82	15625	FKA23ADSO2	F	K	A	2	3	A	D	SO2	<	81.1	125	142.80	68.5	1	2	KM1	E	TANK
83	15627	FKA23ALSO2	F	K	A	2	3	A	L	SO2	<	83.7	125	142.80	70.7	1	3	KM1	E	TANK
84	15628	FKA23BCSO2	F	K	A	2	3	B	C	SO2	<	104.0	125	142.80	87.6	1	4	KM1	E	TANK
85	15629	FKA23BDSO2	F	K	A	2	3	B	D	SO2	<	106.0	125	142.80	89.8	1	5	KM1	E	TANK
86	15630	FKA23BGSO2	F	K	A	2	3	B	G	SO2	<	86.5	125	142.80	73.0	1	7	KM1	E	TANK
87	15631	FKA23BLSO2	F	K	A	2	3	B	L	SO2	<	86.5	125	142.80	73.0	1	6	KM1	E	TANK
88	15632	FKA24ACSO2	F	K	A	2	4	A	C	SO2	<	80.4	30	171.00	68.8	1	1	KM1	E	TANK
89	15633	FKA24ADSO2	F	K	A	2	4	A	D	SO2	<	81.2	30	171.00	69.5	1	2	KM1	E	TANK
90	15635	FKA24ALSO2	F	K	A	2	4	A	L	SO2	<	82.2	30	171.00	70.3	1	3	KM1	E	TANK
91	15637	FKA24BDSO2	F	K	A	2	4	B	D	SO2	<	107.0	30	171.00	91.7	1	5	KM1	E	TANK
92	15638	FKA24BGSO2	F	K	A	2	4	B	G	SO2	<	99.2	30	171.00	84.9	1	7	KM1	E	TANK
93	15639	FKA24BLSO2	F	K	A	2	4	B	L	SO2	<	92.4	30	171.00	79.1	1	6	KM1	E	TANK
94	15700	FKT11ACSO2	F	K	T	1	1	A	C	SO2	<	52.7	552	155.48	40.7	1	1	KTAN	F	TANK
95	15701	FKT11ADSO2	F	K	T	1	1	A	D	SO2	<	68.0	552	155.48	52.6	1	2	KTAN	F	TANK
96	15703	FKT11ALSO2	F	K	T	1	1	A	L	SO2	<	69.0	552	155.48	53.4	1	3	KTAN	F	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYFORT	VLOC	GROUP
97	15704	FKT11BCSO2	F	K	T	1	1	B	C	SO2	<	94.6	552	155.48	79.5	1	4	KTAN	F	TANK
98	15705	FKT11BDSO2	F	K	T	1	1	B	D	SO2	<	69.9	552	155.48	58.7	1	5	KTAN	F	TANK
99	15706	FKT11BGSO2	F	K	T	1	1	B	G	SO2	<	71.6	552	155.48	60.2	1	7	KTAN	F	TANK
100	15707	FKT11BLSO2	F	K	T	1	1	B	L	SO2	<	76.0	552	155.48	63.9	1	6	KTAN	F	TANK
101	15708	FKT12ACSO2	F	K	T	1	2	A	C	SO2	<	77.0	327	154.80	62.9	1	1	KTAN	F	TANK
102	15709	FKT12ADSO2	F	K	T	1	2	A	D	SO2	<	76.3	327	154.80	62.0	1	2	KTAN	F	TANK
103	15711	FKT12ALSO2	F	K	T	1	2	A	L	SO2	<	71.9	327	154.80	59.4	1	3	KTAN	F	TANK
104	15712	FKT12BCSO2	F	K	T	1	2	B	C	SO2	<	78.4	327	154.80	66.6	1	4	KTAN	F	TANK
105	15713	FKT12BDSO2	F	K	T	1	2	B	D	SO2	<	89.7	327	154.80	76.3	1	5	KTAN	F	TANK
106	15714	FKT12BGSO2	F	K	T	1	2	B	G	SO2	<	82.1	327	154.80	69.7	1	7	KTAN	F	TANK
107	15715	FKT12BLSO2	F	K	T	1	2	B	L	SO2	<	80.6	327	154.80	68.5	1	6	KTAN	F	TANK
108	15200	FSM11ACSO2	F	S	M	1	1	A	C	SO2	<	139.0	7	84.00	49.6	1	1	SM10	B	NON
109	15201	FSM11ADSO2	F	S	M	1	1	A	D	SO2	<	146.0	7	84.00	53.8	1	2	SM10	B	NON
110	15203	FSM11ALSO2	F	S	M	1	1	A	L	SO2		566.0	7	84.00	205.0	1	3	SM10	B	NON
111	15204	FSM11BCSO2	F	S	M	1	1	B	C	SO2		144.0	7	84.00	53.8	1	4	SM10	B	NON
112	15205	FSM11BDSO2	F	S	M	1	1	B	D	SO2	<	124.0	7	84.00	47.3	1	5	SM10	B	NON
113	15206	FSM11BLSO2	F	S	M	1	1	B	L	SO2		196.0	7	84.00	74.9	1	6	SM10	B	NON
114	15207	FSM12ACSO2	F	S	M	1	2	A	C	SO2	<	130.0	12	144.00	47.9	1	1	SM10	B	NON
115	15208	FSM12ADSO2	F	S	M	1	2	A	D	SO2		351.0	12	144.00	219.0	1	2	SM10	B	NON
116	15210	FSM12ALSO2	F	S	M	1	2	A	L	SO2	<	120.0	12	144.00	42.3	1	3	SM10	B	NON
117	15211	FSM12BCSO2	F	S	M	1	2	B	C	SO2	<	144.0	12	144.00	54.5	1	4	SM10	B	NON
118	15212	FSM12BDSO2	F	S	M	1	2	B	D	SO2	<	144.0	12	144.00	54.5	1	5	SM10	B	NON
119	15213	FSM12BLSO2	F	S	M	1	2	B	L	SO2	<	150.0	12	144.00	57.3	1	6	SM10	B	NON
120	15217	FSM15ADSO2	F	S	M	1	5	A	D	SO2		181.0	13	156.00	65.1	1	2	SM10	B	NON
121	15225	FSM23ACSO2	F	S	M	2	3	A	C	SO2		281.0	10	120.00	152.0	1	1	SM10	B	NON
122	15226	FSM23ADSO2	F	S	M	2	3	A	D	SO2		8400.0	10	120.00	4550.0	1	2	SM10	B	NON
123	15228	FSM23ALSO2	F	S	M	2	3	A	L	SO2	<	294.0	10	120.00	161.0	1	3	SM10	B	NON
124	15229	FSM23BCSO2	F	S	M	2	3	B	C	SO2		521.0	10	120.00	308.0	1	4	SM10	B	NON
125	15230	FSM23BDSO2	F	S	M	2	3	B	D	SO2	<	308.0	10	120.00	184.0	1	5	SM10	B	NON
126	15231	FSM23BLSO2	F	S	M	2	3	B	L	SO2		333.0	10	120.00	220.0	1	6	SM10	B	NON
127	15232	FSM24ACSO2	F	S	M	2	4	A	C	SO2	<	291.0	10	120.00	108.0	1	1	SM10	B	NON
128	15233	FSM24ADSO2	F	S	M	2	4	A	D	SO2		353.0	10	120.00	204.0	1	2	SM10	B	NON
129	15235	FSM24ALSO2	F	S	M	2	4	A	L	SO2	<	274.0	10	120.00	95.5	1	3	SM10	B	NON
130	15236	FSM24BCSO2	F	S	M	2	4	B	C	SO2		1180.0	10	120.00	463.0	1	4	SM10	B	NON
131	15237	FSM24BDSO2	F	S	M	2	4	B	D	SO2	<	285.0	10	120.00	180.0	1	5	SM10	B	NON
132	15238	FSM24BLSO2	F	S	M	2	4	B	L	SO2	<	282.0	10	120.00	111.0	1	6	SM10	B	NON
133	15100	PSM11ACSO2	P	S	M	3	1	A	C	SO2	<	107.0	12	144.00	41.0	1	1	SM10	B	NON
134	15101	PSM11ADSO2	P	S	M	3	1	A	D	SO2		338.0	12	144.00	130.0	1	2	SM10	B	NON
135	15102	PSM11ALSO2	P	S	M	3	1	A	L	SO2		185.0	12	144.00	70.1	1	3	SM10	B	NON
136	15104	PSM11BCSO2	P	S	M	3	1	B	C	SO2	<	99.2	12	144.00	51.9	1	4	SM10	B	NON
137	15105	PSM11BDSO2	P	S	M	3	1	B	D	SO2		122.0	12	144.00	63.1	1	5	SM10	B	NON
138	15106	PSM11BLSO2	P	S	M	3	1	B	L	SO2	<	99.2	12	144.00	53.1	1	6	SM10	B	NON
139	15107	PSM12ACSO2	P	S	M	3	2	A	C	SO2		189.0	16	192.00	74.1	1	1	SM10	B	NON
140	15108	PSM12ADSO2	P	S	M	3	2	A	D	SO2		93.5	16	192.00	35.8	1	2	SM10	B	NON
141	15109	PSM12ALSO2	P	S	M	3	2	A	L	SO2	<	93.8	16	192.00	36.2	1	3	SM10	B	NON
142	15111	PSM12BCSO2	P	S	M	3	2	B	C	SO2	<	96.0	16	192.00	58.7	1	4	SM10	B	NON
143	15112	PSM12BDSO2	P	S	M	3	2	B	D	SO2	<	96.3	16	192.00	53.3	1	5	SM10	B	NON
144	15113	PSM12BLSO2	P	S	M	3	2	B	L	SO2		107.0	16	192.00	59.7	1	6	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFOR	VLOC	GROUP
145	15118	PSM23ACSO2	P	S	M	4	3	A	C	SO2	<	127.0	17	204	79.9	1	1	SM10	B	NON
146	15119	PSM23ADSO2	P	S	M	4	3	A	D	SO2	<	110.0	17	204	69.3	1	2	SM10	B	NON
147	15120	PSM23ALSO2	P	S	M	4	3	A	L	SO2	<	117.0	17	204	73.6	1	3	SM10	B	NON
148	15122	PSM23BCSO2	P	S	M	4	3	B	C	SO2	<	118.0	17	204	79.1	1	4	SM10	B	NON
149	15123	PSM23BDSO2	P	S	M	4	3	B	D	SO2	<	334.0	17	204	224.0	1	5	SM10	B	NON
150	15124	PSM23BLSO2	P	S	M	4	3	B	L	SO2	<	116.0	17	204	77.8	1	6	SM10	B	NON
151	15125	PSM24ACSO2	P	S	M	4	4	A	C	SO2	<	92.0	16	192	68.4	1	1	SM10	B	NON
152	15126	PSM24ADSO2	P	S	M	4	4	A	D	SO2	<	113.0	16	192	82.8	1	2	SM10	B	NON
153	15127	PSM24ALSO2	P	S	M	4	4	A	L	SO2	<	92.0	16	192	68.4	1	3	SM10	B	NON
154	15129	PSM24BCSO2	P	S	M	4	4	B	C	SO2	<	101.0	16	192	76.8	1	4	SM10	B	NON
155	15130	PSM24BDSO2	P	S	M	4	4	B	D	SO2	<	101.0	16	192	76.6	1	5	SM10	B	NON
156	15131	PSM24BLSO2	P	S	M	4	4	B	L	SO2	<	82.3	16	192	63.6	1	6	SM10	B	NON

RESPIRABLE SUSPENDED PARTICULATE

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYIE	BOOLEAN	FIFCONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYFORT	VLOC	GROUP
1	16302	FBB13ACRSP	F	B	B	1	3	A	C	RSP	<	1380	239	5.08	306	1	1	BBFV	A	NON
2	16303	FBB13ADRSP	F	B	B	1	3	A	D	RSP	<	1450	239	5.08	323	1	2	BBFV	A	NON
3	16305	FBB13ALRSP	F	B	B	1	3	A	L	RSP	<	1440	239	5.08	319	1	3	BBFV	A	NON
4	16306	FBB14ACRSP	F	B	B	1	4	A	C	RSP	<	1450	424	10.00	220	1	1	BBFV	A	NON
5	16307	FBB14ADRSP	F	B	B	1	4	A	D	RSP	<	1540	424	10.00	232	1	2	BBFV	A	NON
6	16309	FBB14ALRSP	F	B	B	1	4	A	L	RSP	<	1470	424	10.00	222	1	3	BBFV	A	NON
7	16315	FBB22ACRSP	F	B	B	2	2	A	C	RSP	<	957	463	12.35	188	1	1	BBFV	A	NON
8	16316	FBB22ADRSP	F	B	B	2	2	A	D	RSP		1530	463	12.35	300	1	2	BBFV	A	NON
9	16318	FBB22ALRSP	F	B	B	2	2	A	L	RSP		2170	463	12.35	425	1	3	BBFV	A	NON
10	16321	FBB25ACRSP	F	B	B	2	5	A	C	RSP	<	870	382	11.53	580	1	1	BBFV	A	NON
11	16322	FBB25ADRSP	F	B	B	2	5	A	D	RSP		945	382	11.53	630	1	2	BBFV	A	NON
12	16324	FBB25ALRSP	F	B	B	2	5	A	L	RSP		1920	382	11.53	1280	1	3	BBFV	A	NON
13	16502	FCT13ACRSP	F	C	T	1	3	A	C	RSP	<	2520	160	58.50	525	1	1	CTAN	C	TANK
14	16503	FCT13ADRSP	F	C	T	1	3	A	D	RSP		2610	160	58.50	555	1	2	CTAN	C	TANK
15	16505	FCT13ALRSP	F	C	T	1	3	A	L	RSP	<	2450	160	58.50	499	1	3	CTAN	C	TANK
16	16506	FCT14ACRSP	F	C	T	1	4	A	C	RSP	<	2920	163	75.60	270	1	1	CTAN	C	TANK
17	16507	FCT14ADRSP	F	C	T	1	4	A	D	RSP	<	2750	163	75.60	255	1	2	CTAN	C	TANK
18	16509	FCT14ALRSP	F	C	T	1	4	A	L	RSP	<	2470	163	75.60	230	1	3	CTAN	C	TANK
19	16511	FCT21ACRSP	F	C	T	2	1	A	C	RSP	<	2670	162	69.90	1330	1	1	CTAN	C	TANK
20	16512	FCT21ADRSP	F	C	T	2	1	A	D	RSP	<	2710	162	69.90	1360	1	2	CTAN	C	TANK
21	16514	FCT21ALRSP	F	C	T	2	1	A	L	RSP	<	2600	162	69.90	1300	1	3	CTAN	C	TANK
22	16515	FCT22ACRSP	F	C	T	2	2	A	C	RSP	<	2470	166	92.70	760	1	1	CTAN	C	TANK
23	16516	FCT22ADRSP	F	C	T	2	2	A	D	RSP	<	3020	166	92.70	928	1	2	CTAN	C	TANK
24	16518	FCT22ALRSP	F	C	T	2	2	A	L	RSP	<	2610	166	92.70	802	1	3	CTAN	C	TANK
25	16602	FKA13ACRSP	F	K	A	1	3	A	C	RSP	<	353	272	126.15	257	1	1	KM1	E	TANK
26	16603	FKA13ADRSP	F	K	A	1	3	A	D	RSP	<	353	272	126.15	257	1	2	KM1	E	TANK
27	16605	FKA13ALRSP	F	K	A	1	3	A	L	RSP	<	353	272	126.15	257	1	3	KM1	E	TANK
28	16606	FKA14ACRSP	F	K	A	1	4	A	C	RSP	<	531	118	102.90	355	1	1	KM1	E	TANK
29	16607	FKA14ADRSP	F	K	A	1	4	A	D	RSP	<	531	118	102.90	355	1	2	KM1	E	TANK
30	16609	FKA14ALRSP	F	K	A	1	4	A	L	RSP		1480	118	102.90	990	1	3	KM1	E	TANK
31	16611	FKA21ACRSP	F	K	A	2	1	A	C	RSP	<	251	178	160.05	178	1	1	KM1	E	TANK
32	16612	FKA21ADRSP	F	K	A	2	1	A	D	RSP	<	241	178	160.05	170	1	2	KM1	E	TANK
33	16614	FKA21ALRSP	F	K	A	2	1	A	L	RSP		300	178	160.05	212	1	3	KM1	E	TANK
34	16615	FKA22ACRSP	F	K	A	2	2	A	C	RSP	<	297	124	137.10	208	1	1	KM1	E	TANK
35	16616	FKA22ADRSP	F	K	A	2	2	A	D	RSP		2660	124	137.10	1870	1	2	KM1	E	TANK
36	16618	FKA22ALRSP	F	K	A	2	2	A	L	RSP		724	124	137.10	508	1	3	KM1	E	TANK
37	16624	FKA25ALRSP	F	K	A	2	5	A	L	RSP	<	257	77	154.15	181	1	3	KM1	E	TANK
38	16702	FKT13ACRSP	F	K	T	1	3	A	C	RSP		203	331	177.60	160	1	1	KTAN	F	TANK
39	16703	FKT13ADRSP	F	K	T	1	3	A	D	RSP		293	331	177.60	231	1	2	KTAN	F	TANK
40	16705	FKT13ALRSP	F	K	T	1	3	A	L	RSP	<	210	331	177.60	168	1	3	KTAN	F	TANK
41	16706	FKT14ACRSP	F	K	T	1	4	A	C	RSP		166	577	155.55	130	1	1	KTAN	F	TANK
42	16707	FKT14ADRSP	F	K	T	1	4	A	D	RSP		248	577	155.55	192	1	2	KTAN	F	TANK
43	16709	FKT14ALRSP	F	K	T	1	4	A	L	RSP	<	166	577	155.55	130	1	3	KTAN	F	TANK
44	16202	FSM13ACRSP	F	S	M	1	3	A	C	RSP	<	338	12	144.00	140	1	1	SM10	B	NON
45	16203	FSM13ADRSP	F	S	M	1	3	A	D	RSP	<	338	12	144.00	140	1	2	SM10	B	NON
46	16205	FSM13ALRSP	F	S	M	1	3	A	L	RSP	<	336	12	144.00	139	1	3	SM10	B	NON
47	16206	FSM14ACRSP	F	S	M	1	4	A	C	RSP		729	16	192.00	166	1	1	SM10	B	NON
48	16207	FSM14ADRSP	F	S	M	1	4	A	D	RSP		820	16	192.00	193	1	2	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	16209	FSM14ALRSP	F	S	M	1	4	A	L	RSP	<	741	16	192	177	1	3	SM10	B	NON
50	16211	FSM21ACRSP	F	S	M	2	1	A	C	RSP	<	851	10	120	476	1	1	SM10	B	NON
51	16212	FSM21ADRSP	F	S	M	2	1	A	D	RSP	<	848	10	120	432	1	2	SM10	B	NON
52	16214	FSM21ALRSP	F	S	M	2	1	A	L	RSP	<	836	10	120	446	1	3	SM10	B	NON
53	16215	FSM22ACRSP	F	S	M	2	2	A	C	RSP	<	946	8	96	506	1	1	SM10	B	NON
54	16216	FSM22ADRSP	F	S	M	2	2	A	D	RSP	<	913	8	96	524	1	2	SM10	B	NON
55	16218	FSM22ALRSP	F	S	M	2	2	A	L	RSP	<	882	8	96	484	1	3	SM10	B	NON
56	16102	PSM13ACRSP	P	S	M	3	3	A	C	RSP	<	760	16	192	238	1	1	SM10	B	NON
57	16103	PSM13ADRSP	P	S	M	3	3	A	D	RSP	<	372	16	192	114	1	2	SM10	B	NON
58	16104	PSM13ALRSP	P	S	M	3	3	A	L	RSP		520	16	192	158	1	3	SM10	B	NON
59	16106	PSM14ACRSP	P	S	M	3	4	A	C	RSP	<	407	16	192	131	1	1	SM10	B	NON
60	16107	PSM14ADRSP	P	S	M	3	4	A	D	RSP	<	398	16	192	123	1	2	SM10	B	NON
61	16108	PSM14ALRSP	P	S	M	3	4	A	L	RSP	<	364	16	192	117	1	3	SM10	B	NON
62	16110	PSM21ACRSP	P	S	M	4	1	A	C	RSP	<	364	16	192	253	1	1	SM10	B	NON
63	16111	PSM21ADRSP	P	S	M	4	1	A	D	RSP	<	329	16	192	227	1	2	SM10	B	NON
64	16112	PSM21ALRSP	P	S	M	4	1	A	L	RSP	<	488	16	192	335	1	3	SM10	B	NON
65	16114	PSM22ACRSP	P	S	M	4	2	A	C	RSP	<	371	18	216	269	1	1	SM10	B	NON
66	16115	PSM22ADRSP	P	S	M	4	2	A	D	RSP	<	338	18	216	245	1	2	SM10	B	NON
67	16116	PSM22ALRSP	P	S	M	4	2	A	L	RSP	<	358	18	216	259	1	3	SM10	B	NON

TOTAL SUSPENDED PARTICULATES

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFOR	VLOC	GROUP
1	17302	FBB13ACTSP	F	B	B	1	3	A	C	TSP	<	1360	239	5.08	303	1	1	BBFV	A	NON
2	17303	FBB13ADTSP	F	B	B	1	3	A	D	TSP		55600	239	5.08	12400	1	2	BBFV	A	NON
3	17305	FBB13ALTSP	F	B	B	1	3	A	L	TSP	<	1370	239	5.08	304	1	3	BBFV	A	NON
4	17306	FBB13BCTSP	F	B	B	1	3	B	C	TSP	<	1380	239	5.08	306	1	4	BBFV	A	NON
5	17307	FBB13BDTSP	F	B	B	1	3	B	D	TSP		1420	239	5.08	316	1	5	BBFV	A	NON
6	17308	FBB13BLTSP	F	B	B	1	3	B	L	TSP		3030	239	5.08	674	1	6	BBFV	A	NON
7	17309	FBB14ACTSP	F	B	B	1	4	A	C	TSP		2070	424	10.00	315	1	1	BBFV	A	NON
8	17310	FBB14ADTSP	F	B	B	1	4	A	D	TSP	<	1480	424	10.00	224	1	2	BBFV	A	NON
9	17312	FBB14ALTSP	F	B	B	1	4	A	L	TSP		4730	424	10.00	714	1	3	BBFV	A	NON
10	17313	FBB14BCTSP	F	B	B	1	4	B	C	TSP		2310	424	10.00	348	1	4	BBFV	A	NON
11	17314	FBB14BDTSP	F	B	B	1	4	B	D	TSP	<	1680	424	10.00	336	1	5	BBFV	A	NON
12	17315	FBB14BLTSP	F	B	B	1	4	B	L	TSP		2120	424	10.00	423	1	6	BBFV	A	NON
13	17324	FBB22ACTSP	F	B	B	2	2	A	C	TSP		2800	463	12.35	549	1	1	BBFV	A	NON
14	17325	FBB22ADTSP	F	B	B	2	2	A	D	TSP		3290	463	12.35	646	1	2	BBFV	A	NON
15	17327	FBB22ALTSP	F	B	B	2	2	A	L	TSP		3310	463	12.35	649	1	3	BBFV	A	NON
16	17328	FBB22BCTSP	F	B	B	2	2	B	C	TSP		2730	463	12.35	535	1	4	BBFV	A	NON
17	17329	FBB22BDTSP	F	B	B	2	2	B	D	TSP		3970	463	12.35	779	1	5	BBFV	A	NON
18	17330	FBB22BLTSP	F	B	B	2	2	B	L	TSP		2560	463	12.35	501	1	6	BBFV	A	NON
19	17333	FBB25ACTSP	F	B	B	2	5	A	C	TSP		2960	382	11.53	1970	1	1	BBFV	A	NON
20	17334	FBB25ADTSP	F	B	B	2	5	A	D	TSP		2390	382	11.53	1590	1	2	BBFV	A	NON
21	17336	FBB25ALTSP	F	B	B	2	5	A	L	TSP		6140	382	11.53	4090	1	3	BBFV	A	NON
22	17337	FBB25BCTSP	F	B	B	2	5	B	C	TSP		1750	382	11.53	1170	1	4	BBFV	A	NON
23	17338	FBB25BDTSP	F	B	B	2	5	B	D	TSP		1980	382	11.53	1320	1	5	BBFV	A	NON
24	17339	FBB25BLTSP	F	B	B	2	5	B	L	TSP		1850	382	11.53	1230	1	6	BBFV	A	NON
25	17502	FCT13ACTSP	F	C	T	1	3	A	C	TSP		13200	160	58.50	2750	1	1	CTAN	C	TANK
26	17503	FCT13ADTSP	F	C	T	1	3	A	D	TSP		5700	160	58.50	1210	1	2	CTAN	C	TANK
27	17505	FCT13ALTSP	F	C	T	1	3	A	L	TSP		11200	160	58.50	2290	1	3	CTAN	C	TANK
28	17506	FCT13BCTSP	F	C	T	1	3	B	C	TSP		6140	160	58.50	1390	1	4	CTAN	C	TANK
29	17507	FCT13BDTSP	F	C	T	1	3	B	D	TSP		4160	160	58.50	913	1	5	CTAN	C	TANK
30	17540	FCT13BGTSP	F	C	T	1	3	B	G	TSP		3400	160	58.50	739	1	7	CTAN	C	TANK
31	17508	FCT13BLTSP	F	C	T	1	3	B	L	TSP		4950	160	58.50	1160	1	6	CTAN	C	TANK
32	17509	FCT14ACTSP	F	C	T	1	4	A	C	TSP		10300	163	75.60	946	1	1	CTAN	C	TANK
33	17510	FCT14ADTSP	F	C	T	1	4	A	D	TSP		4120	163	75.60	382	1	2	CTAN	C	TANK
34	17512	FCT14ALTSP	F	C	T	1	4	A	L	TSP		7370	163	75.60	686	1	3	CTAN	C	TANK
35	17513	FCT14BCTSP	F	C	T	1	4	B	C	TSP		6760	163	75.60	644	1	4	CTAN	C	TANK
36	17514	FCT14BDTSP	F	C	T	1	4	B	D	TSP		6900	163	75.60	651	1	5	CTAN	C	TANK
37	17541	FCT14BGTSP	F	C	T	1	4	B	G	TSP		3750	163	75.60	361	1	7	CTAN	C	TANK
38	17515	FCT14BLTSP	F	C	T	1	4	B	L	TSP		4900	163	75.60	467	1	6	CTAN	C	TANK
39	17517	FCT21ACTSP	F	C	T	2	1	A	C	TSP	<	2740	162	69.90	1370	1	1	CTAN	C	TANK
40	17518	FCT21ADTSP	F	C	T	2	1	A	D	TSP		7190	162	69.90	3590	1	2	CTAN	C	TANK
41	17520	FCT21ALTSP	F	C	T	2	1	A	L	TSP		2610	162	69.90	1300	1	3	CTAN	C	TANK
42	17521	FCT21BCTSP	F	C	T	2	1	B	C	TSP	<	2630	162	69.90	1320	1	4	CTAN	C	TANK
43	17522	FCT21BDTSP	F	C	T	2	1	B	D	TSP		2900	162	69.90	1450	1	5	CTAN	C	TANK
44	17542	FCT21BGTSP	F	C	T	2	1	B	G	TSP		3750	162	69.90	1870	1	7	CTAN	C	TANK
45	17523	FCT21BLTSP	F	C	T	2	1	B	L	TSP		2750	162	69.90	1380	1	6	CTAN	C	TANK
46	17524	FCT22ACTSP	F	C	T	2	2	A	C	TSP	<	2480	166	92.70	762	1	1	CTAN	C	TANK
47	17525	FCT22ADTSP	F	C	T	2	2	A	D	TSP	<	2890	166	92.70	888	1	2	CTAN	C	TANK
48	17527	FCT22ALTSP	F	C	T	2	2	A	L	TSP	<	2750	166	92.70	845	1	3	CTAN	C	TANK

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
49	17528	FCT22BCTSP	F	C	T	2	2	B	C	TSP	<	2550	166	92.70	784	1	4	CTAN	C	TANK
50	17529	FCT22BDTSP	F	C	T	2	2	B	D	TSP		3380	166	92.70	1040	1	5	CTAN	C	TANK
51	17543	FCT22BGTSP	F	C	T	2	2	B	G	TSP	<	2270	166	92.70	698	1	7	CTAN	C	TANK
52	17530	FCT22BLTSP	F	C	T	2	2	B	L	TSP	<	2710	166	92.70	833	1	6	CTAN	C	TANK
53	17602	FKA13ACTSP	F	K	A	1	3	A	C	TSP		636	272	126.15	463	1	1	KM1	E	TANK
54	17603	FKA13ADTSP	F	K	A	1	3	A	D	TSP		353	272	126.15	257	1	2	KM1	E	TANK
55	17605	FKA13ALTSP	F	K	A	1	3	A	L	TSP		947	272	126.15	690	1	3	KM1	E	TANK
56	17606	FKA13BCTSP	F	K	A	1	3	B	C	TSP		1100	272	126.15	893	1	4	KM1	E	TANK
57	17607	FKA13BDTSP	F	K	A	1	3	B	D	TSP		537	272	126.15	436	1	5	KM1	E	TANK
58	17608	FKA13BGTSP	F	K	A	1	3	B	G	TSP		545	272	126.15	443	1	7	KM1	E	TANK
59	17609	FKA13BLTSP	F	K	A	1	3	B	L	TSP		718	272	126.15	583	1	6	KM1	E	TANK
60	17610	FKA14ACTSP	F	K	A	1	4	A	C	TSP		531	118	102.90	355	1	1	KM1	E	TANK
61	17611	FKA14ADTSP	F	K	A	1	4	A	D	TSP		531	118	102.90	355	1	2	KM1	E	TANK
62	17613	FKA14ALTSP	F	K	A	1	4	A	L	TSP		531	118	102.90	355	1	3	KM1	E	TANK
63	17614	FKA14BCTSP	F	K	A	1	4	B	C	TSP		1210	118	102.90	809	1	4	KM1	E	TANK
64	17615	FKA14BDTSP	F	K	A	1	4	B	D	TSP		541	118	102.90	362	1	5	KM1	E	TANK
65	17616	FKA14BGTSP	F	K	A	1	4	B	G	TSP		1580	118	102.90	1050	1	7	KM1	E	TANK
66	17617	FKA14BLTSP	F	K	A	1	4	B	L	TSP		1560	118	102.90	1040	1	6	KM1	E	TANK
67	17619	FKA21ACTSP	F	K	A	2	1	A	C	TSP		248	178	160.05	175	1	1	KM1	E	TANK
68	17620	FKA21ADTSP	F	K	A	2	1	A	D	TSP		601	178	160.05	425	1	2	KM1	E	TANK
69	17622	FKA21ALTSP	F	K	A	2	1	A	L	TSP		449	178	160.05	318	1	3	KM1	E	TANK
70	17623	FKA21BCTSP	F	K	A	2	1	B	C	TSP		670	178	160.05	474	1	4	KM1	E	TANK
71	17624	FKA21BDTSP	F	K	A	2	1	B	D	TSP		255	178	160.05	181	1	5	KM1	E	TANK
72	17625	FKA21BGTSP	F	K	A	2	1	B	G	TSP		741	178	160.05	524	1	7	KM1	E	TANK
73	17626	FKA21BLTSP	F	K	A	2	1	B	L	TSP		771	178	160.05	546	1	6	KM1	E	TANK
74	17627	FKA22ACTSP	F	K	A	2	2	A	C	TSP		783	124	137.10	550	1	1	KM1	E	TANK
75	17628	FKA22ADTSP	F	K	A	2	2	A	D	TSP		827	124	137.10	581	1	2	KM1	E	TANK
76	17630	FKA22ALTSP	F	K	A	2	2	A	L	TSP		592	124	137.10	416	1	3	KM1	E	TANK
77	17631	FKA22BCTSP	F	K	A	2	2	B	C	TSP		856	124	137.10	601	1	4	KM1	E	TANK
78	17632	FKA22BDTSP	F	K	A	2	2	B	D	TSP		379	124	137.10	266	1	5	KM1	E	TANK
79	17633	FKA22BGTSP	F	K	A	2	2	B	G	TSP		696	124	137.10	489	1	7	KM1	E	TANK
80	17634	FKA22BLTSP	F	K	A	2	2	B	L	TSP		1080	124	137.10	761	1	6	KM1	E	TANK
81	17640	FKA25ALTSP	F	K	A	2	5	A	L	TSP		389	77	154.15	274	1	3	KM1	E	TANK
82	17702	FKT13ACTSP	F	K	T	1	3	A	C	TSP		355	331	177.60	280	1	1	KTAN	F	TANK
83	17703	FKT13ADTSP	F	K	T	1	3	A	D	TSP		711	331	177.60	561	1	2	KTAN	F	TANK
84	17705	FKT13ALTSP	F	K	T	1	3	A	L	TSP		418	331	177.60	334	1	3	KTAN	F	TANK
85	17706	FKT13BCTSP	F	K	T	1	3	B	C	TSP		933	331	177.60	774	1	4	KTAN	F	TANK
86	17707	FKT13BDTSP	F	K	T	1	3	B	D	TSP		4510	331	177.60	3680	1	5	KTAN	F	TANK
87	17709	FKT13BLTSP	F	K	T	1	3	B	L	TSP		773	331	177.60	625	1	6	KTAN	F	TANK
88	17710	FKT14ACTSP	F	K	T	1	4	A	C	TSP		431	577	155.55	337	1	1	KTAN	F	TANK
89	17711	FKT14ADTSP	F	K	T	1	4	A	D	TSP		405	577	155.55	313	1	2	KTAN	F	TANK
90	17713	FKT14ALTSP	F	K	T	1	4	A	L	TSP		506	577	155.55	396	1	3	KTAN	F	TANK
91	17714	FKT14BCTSP	F	K	T	1	4	B	C	TSP		510	577	155.55	411	1	4	KTAN	F	TANK
92	17715	FKT14BDTSP	F	K	T	1	4	B	D	TSP		730	577	155.55	588	1	5	KTAN	F	TANK
93	17716	FKT14BGTSP	F	K	T	1	4	B	G	TSP		464	577	155.55	374	1	7	KTAN	F	TANK
94	17717	FKT14BLTSP	F	K	T	1	4	B	L	TSP		504	577	155.55	406	1	6	KTAN	F	TANK
95	17202	FSM13ACTSP	F	S	M	1	3	A	C	TSP	<	437	12	144.00	181	1	1	SM10	B	NON
96	17203	FSM13ADTSP	F	S	M	1	3	A	D	TSP		848	12	144.00	352	1	2	SM10	B	NON

OBS	LABNO	FLDCODE	SCALE	FORT	VEHTYP	DAY	VEHNO	FIXBZ	AREAPRSN	ANALYTE	BOLEAN	FIRECONC	TOTCAL	TOTMASS	TOTCONC	SELECT	TREAT	VTYPFORT	VLOC	GROUP
97	17205	FSM13ALTSP	F	S	M	1	3	A	L	TSP		443	12	144	184	1	3	SM10	B	NON
98	17206	FSM13BCTSP	F	S	M	1	3	B	C	TSP		876	12	144	363	1	4	SM10	B	NON
99	17207	FSM13BDTSP	F	S	M	1	3	B	D	TSP		818	12	144	339	1	5	SM10	B	NON
100	17208	FSM13BLTSP	F	S	M	1	3	B	L	TSP		393	12	144	163	1	6	SM10	B	NON
101	17209	FSM14ACTSP	F	S	M	1	4	A	C	TSP		9000	16	192	2050	1	1	SM10	B	NON
102	17210	FSM14ADTSP	F	S	M	1	4	A	D	TSP		2240	16	192	526	1	2	SM10	B	NON
103	17212	FSM14ALTSP	F	S	M	1	4	A	L	TSP		1230	16	192	295	1	3	SM10	B	NON
104	17213	FSM14BCTSP	F	S	M	1	4	B	C	TSP		2080	16	192	524	1	4	SM10	B	NON
105	17214	FSM14BDTSP	F	S	M	1	4	B	D	TSP		2280	16	192	570	1	5	SM10	B	NON
106	17215	FSM14BLTSP	F	S	M	1	4	B	L	TSP		1050	16	192	266	1	6	SM10	B	NON
107	17217	FSM21ACTSP	F	S	M	2	1	A	C	TSP	<	846	10	120	474	1	1	SM10	B	NON
108	17218	FSM21ADTSP	F	S	M	2	1	A	D	TSP		1800	10	120	915	1	2	SM10	B	NON
109	17220	FSM21ALTSP	F	S	M	2	1	A	L	TSP	<	851	10	120	454	1	3	SM10	B	NON
110	17221	FSM21BCTSP	F	S	M	2	1	B	C	TSP		1710	10	120	834	1	4	SM10	B	NON
111	17222	FSM21BDTSP	F	S	M	2	1	B	D	TSP	<	848	10	120	413	1	5	SM10	B	NON
112	17223	FSM21BLTSP	F	S	M	2	1	B	L	TSP		2200	10	120	1070	1	6	SM10	B	NON
113	17224	FSM22ACTSP	F	S	M	2	2	A	C	TSP		1500	8	96	802	1	1	SM10	B	NON
114	17225	FSM22ADTSP	F	S	M	2	2	A	D	TSP		897	8	96	515	1	2	SM10	B	NON
115	17227	FSM22ALTSP	F	S	M	2	2	A	L	TSP	<	905	8	96	497	1	3	SM10	B	NON
116	17228	FSM22BCTSP	F	S	M	2	2	B	C	TSP		1190	8	96	684	1	4	SM10	B	NON
117	17229	FSM22BDTSP	F	S	M	2	2	B	D	TSP		1240	8	96	724	1	5	SM10	B	NON
118	17230	FSM22BLTSP	F	S	M	2	2	B	L	TSP		1170	8	96	674	1	6	SM10	B	NON
119	17102	PSM13ACTSP	P	S	M	3	3	A	C	TSP		662	16	192	207	1	1	SM10	B	NON
120	17103	PSM13ADTSP	P	S	M	3	3	A	D	TSP	<	369	16	192	113	1	2	SM10	B	NON
121	17104	PSM13ALTSP	P	S	M	3	3	A	L	TSP	<	384	16	192	117	1	3	SM10	B	NON
122	17106	PSM13BCTSP	P	S	M	3	3	B	C	TSP	<	380	16	192	178	1	4	SM10	B	NON
123	17107	PSM13BDTSP	P	S	M	3	3	B	D	TSP	<	586	16	192	268	1	5	SM10	B	NON
124	17108	PSM13BLTSP	P	S	M	3	3	B	L	TSP	<	586	16	192	267	1	6	SM10	B	NON
125	17109	PSM14ACTSP	P	S	M	3	4	A	C	TSP		1100	16	192	355	1	1	SM10	B	NON
126	17110	PSM14ADTSP	P	S	M	3	4	A	D	TSP		600	16	192	185	1	2	SM10	B	NON
127	17111	PSM14ALTSP	P	S	M	3	4	A	L	TSP	<	399	16	192	128	1	3	SM10	B	NON
128	17113	PSM14BCTSP	P	S	M	3	4	B	C	TSP		10600	16	192	5150	1	4	SM10	B	NON
129	17114	PSM14BDTSP	P	S	M	3	4	B	D	TSP	<	367	16	192	176	1	5	SM10	B	NON
130	17115	PSM14BLTSP	P	S	M	3	4	B	L	TSP	<	388	16	192	191	1	6	SM10	B	NON
131	17116	PSM21ACTSP	P	S	M	4	1	A	C	TSP	<	364	16	192	253	1	1	SM10	B	NON
132	17117	PSM21ADTSP	P	S	M	4	1	A	D	TSP	<	329	16	192	227	1	2	SM10	B	NON
133	17118	PSM21ALTSP	P	S	M	4	1	A	L	TSP	<	439	16	192	302	1	3	SM10	B	NON
134	17120	PSM21BCTSP	P	S	M	4	1	B	C	TSP	<	329	16	192	230	1	4	SM10	B	NON
135	17121	PSM21BDTSP	P	S	M	4	1	B	D	TSP	<	497	16	192	348	1	5	SM10	B	NON
136	17122	PSM21BLTSP	P	S	M	4	1	B	L	TSP	<	376	16	192	263	1	6	SM10	B	NON
137	17123	PSM22ACTSP	P	S	M	4	2	A	C	TSP		456	18	216	330	1	1	SM10	B	NON
138	17124	PSM22ADTSP	P	S	M	4	2	A	D	TSP	<	347	18	216	251	1	2	SM10	B	NON
139	17125	PSM22ALTSP	P	S	M	4	2	A	L	TSP	<	351	18	216	254	1	3	SM10	B	NON
140	17127	PSM22BCTSP	P	S	M	4	2	B	C	TSP		565	18	216	409	1	4	SM10	B	NON
141	17128	PSM22BDTSP	P	S	M	4	2	B	D	TSP	<	376	18	216	272	1	5	SM10	B	NON
142	17129	PSM22BLTSP	P	S	M	4	2	B	L	TSP	<	462	18	216	334	1	6	SM10	B	NON

This page intentionally blank.

ALDEHYDES

CONCENTRATION (TOTCONC) OF ALDEHYDES (UG/M3)

LABNO	FLDCODE	ACETAL (UG/M3)	ACROLEIN (UG/M3)	CROTONAL (UG/M3)	BUTYRAL (UG/M3)	BENZAL (UG/M3)	HEXANAL (UG/M3)	TOTCAL (NO.)	TOTMASS (KG)
1101	PSM12AGALD	2.64E+01	< 3.00E-01	6.50E-01	2.65E+00	6.83E-01	< 3.83E-01	16	192.00
1102	PSM13ACALD	< 2.41E-01	< 3.10E-01	< 2.41E-01	< 6.38E-01	< 5.17E-01	< 3.97E-01	16	192.00
1103	PSM13ADALD	3.34E-01	< 3.34E-01	< 2.60E-01	< 6.86E-01	< 5.56E-01	< 4.27E-01	16	192.00
1104	PSM13ALALD	< 2.27E-01	< 2.92E-01	< 2.27E-01	< 6.00E-01	< 4.86E-01	< 3.73E-01	16	192.00
1105	PSM13AGALD	2.66E+01	< 2.92E-01	4.86E-01	2.97E+00	1.33E+00	< 3.73E-01	16	192.00
1106	PSM14ACALD	< 2.65E-01	< 3.41E-01	< 2.65E-01	< 7.01E-01	< 5.68E-01	< 4.36E-01	16	192.00
1107	PSM14ADALD	1.63E+00	< 3.85E-01	< 3.00E-01	< 7.92E-01	< 6.42E-01	< 4.92E-01	16	192.00
1108	PSM14ALALD	< 2.83E-01	< 3.63E-01	< 2.83E-01	< 7.47E-01	< 6.06E-01	< 4.64E-01	16	192.00
1109	PSM14AGALD	2.06E+00	< 3.63E-01	< 2.83E-01	< 7.47E-01	< 6.06E-01	< 4.64E-01	16	192.00
1110	PSM21ACALD	< 4.67E-01	< 6.01E-01	< 4.67E-01	< 1.23E+00	< 1.00E+00	< 7.67E-01	16	192.00
1111	PSM21ADALD	< 5.19E-01	< 6.68E-01	< 5.19E-01	< 1.37E+00	< 1.11E+00	< 8.53E-01	16	192.00
1112	PSM21ALALD	< 4.15E-01	< 5.34E-01	< 4.15E-01	< 1.10E+00	< 8.90E-01	< 6.82E-01	16	192.00
1113	PSM21AGALD	4.33E+01	< 7.38E-01	7.38E-01	1.25E+01	9.22E+00	1.80E+00	16	192.00
1114	PSM22ACALD	8.92E-01	< 6.69E-01	< 5.20E-01	< 1.37E+00	< 1.11E+00	< 8.54E-01	18	216.00
1115	PSM22ADALD	6.10E-01	< 6.86E-01	< 5.34E-01	< 1.41E+00	< 1.14E+00	< 8.77E-01	18	216.00
1116	PSM22ALALD	2.18E+00	< 5.45E-01	< 4.24E-01	< 1.12E+00	< 9.08E-01	< 6.96E-01	18	216.00
1200	FSM11AGALD	< 3.03E-01	< 2.42E-01	< 4.24E-01	< 5.14E-01	< 6.66E-01	< 5.75E-01	18	216.00
1202	FSM13ACALD	2.15E+00	< 1.74E-01	< 3.04E-01	< 3.69E-01	< 4.78E-01	< 4.13E-01	12	144.00
1203	FSM13ADALD	1.43E+01	< 1.74E-01	< 3.04E-01	< 3.69E-01	< 4.78E-01	< 4.13E-01	12	144.00
1205	FSM13ALALD	4.69E+00	< 1.79E-01	< 3.13E-01	< 3.80E-01	< 4.91E-01	< 4.24E-01	12	144.00
1206	FSM14ACALD	3.37E+00	< 2.08E-01	< 3.63E-01	< 4.41E-01	< 5.71E-01	< 4.93E-01	16	192.00
1207	FSM14ADALD	5.58E-01	< 2.35E-01	< 4.11E-01	< 5.00E-01	< 6.46E-01	< 5.58E-01	16	192.00
1209	FSM14ALALD	7.47E+00	< 2.13E-01	< 3.73E-01	< 4.53E-01	9.07E-01	< 5.07E-01	16	192.00
1211	FSM21ACALD	8.22E+00	< 5.48E-01	< 9.59E-01	< 1.16E+00	< 1.51E+00	< 1.30E+00	10	120.00
1212	FSM21ADALD	5.99E+00	< 5.32E-01	< 9.32E-01	< 1.13E+00	< 1.46E+00	< 1.26E+00	10	120.00
1214	FSM21ALALD	4.53E+00	< 5.84E-01	< 1.02E+00	< 1.24E+00	< 1.61E+00	< 1.39E+00	10	120.00
1215	FSM22ACALD	< 8.02E-01	9.63E-01	< 1.12E+00	< 1.36E+00	< 1.77E+00	< 1.52E+00	8	96.00
1216	FSM22ADALD	2.99E+00	1.06E+00	< 1.35E+00	< 1.64E+00	< 2.12E+00	< 1.83E+00	8	96.00
1218	FSM22ALALD	1.66E+00	< 6.03E-01	< 1.06E+00	< 1.28E+00	< 1.66E+00	< 1.43E+00	8	96.00
1221	FSM25ACALD	8.87E+00	< 6.45E-01	< 1.13E+00	< 1.37E+00	< 1.77E+00	< 1.53E+00	8	96.00
1222	FSM25ADALD	< 7.76E-01	< 6.21E-01	< 1.09E+00	< 1.32E+00	< 1.71E+00	< 1.47E+00	8	96.00
1224	FSM25ALALD	2.59E+02	< 7.66E-01	2.78E+00	< 1.63E+00	2.30E+00	< 1.82E+00	8	96.00
1302	FBB13ACALD	< 4.65E-01	< 3.72E-01	< 6.51E-01	< 7.90E-01	< 1.02E+00	< 8.83E-01	239	5.08
1303	FBB13ADALD	8.06E+00	< 3.79E-01	< 6.63E-01	1.71E+01	< 1.04E+00	< 9.00E-01	239	5.08
1305	FBB13ALALD	4.03E+00	< 3.84E-01	< 6.72E-01	< 8.16E-01	< 1.06E+00	< 9.12E-01	239	5.08
1306	FBB14ACALD	7.50E+00	< 2.86E-01	< 5.00E-01	9.64E+00	9.28E-01	7.14E-01	424	10.00
1307	FBB14ADALD	5.64E+00	< 2.51E-01	< 4.38E-01	1.16E+01	< 6.89E-01	< 5.95E-01	424	10.00
1309	FBB14ALALD	2.67E+00	< 2.46E-01	< 4.30E-01	< 5.22E-01	< 6.75E-01	< 5.83E-01	424	10.00

CONCENTRATION (TOTCONC) OF ALDEHYDES (UG/M3)

LABNO	FLDCODE	ACETAL (UG/M3)	ACROLEIN (UG/M3)	CROTONAL (UG/M3)	BUTYRAL (UG/M3)	BENZAL (UG/M3)	HEXANAL (UG/M3)	TOTCAL (NO.)	TOTMASS (KG)
1311	FBB21ACALD	5.47E+00	< 2.57E-01	< 4.50E-01	4.18E+01	9.97E-01	6.43E-01	467	12.75
1312	FBB21ADALD	3.50E-01	< 2.54E-01	< 4.45E-01	< 5.40E-01	< 6.99E-01	< 6.04E-01	467	12.75
1314	FBB21ALALD	1.54E+00	< 2.46E-01	< 4.30E-01	< 5.22E-01	8.61E-01	< 5.84E-01	467	12.75
1315	FBB22ACALD	1.17E+00	< 2.13E-01	< 3.73E-01	< 4.53E-01	< 5.87E-01	< 5.07E-01	463	12.35
1316	FBB22ADALD	< 2.85E-01	< 2.28E-01	< 3.98E-01	< 4.84E-01	< 6.26E-01	< 5.41E-01	463	12.35
1318	FBB22ALALD	< 2.86E-01	< 2.28E-01	< 4.00E-01	2.11E+00	< 6.28E-01	< 5.43E-01	463	12.35
1321	FBB25ACALD	2.77E+00	< 7.14E-01	< 1.25E+00	< 1.52E+00	< 1.96E+00	< 1.69E+00	382	11.53
1322	FBB25ADALD	< 8.80E-01	< 7.04E-01	< 1.23E+00	< 1.50E+00	< 1.94E+00	< 1.67E+00	382	11.53
1324	FBB25ALALD	5.13E+00	< 7.07E-01	< 1.24E+00	< 1.50E+00	< 1.94E+00	< 1.68E+00	382	11.53
1502	FCT13ACALD	4.73E+00	< 2.30E+00	< 1.79E+00	< 2.68E+00	< 3.32E+00	4.98E+00	160	58.50
1503	FCT13ADALD	8.06E+00	< 2.13E+00	< 1.66E+00	< 2.49E+00	< 3.08E+00	3.44E+00	160	58.50
1505	FCT13ALALD	6.29E+00	< 2.02E+00	< 1.57E+00	< 2.36E+00	< 2.92E+00	3.59E+00	160	58.50
1506	FCT14ACALD	4.18E+00	< 1.02E+00	< 7.91E-01	< 1.19E+00	< 1.47E+00	5.26E+00	163	75.60
1507	FCT14ADALD	9.25E+00	< 9.79E-01	< 7.61E-01	< 1.14E+00	< 1.41E+00	5.98E+00	163	75.60
1509	FCT14ALALD	5.20E+00	< 9.37E-01	< 7.29E-01	2.24E+00	< 1.35E+00	6.25E+00	163	75.60
1511	FCT21ACALD	1.13E+01	< 5.20E+00	< 4.04E+00	< 6.07E+00	< 7.51E+00	< 8.09E+00	162	69.90
1512	FCT21ADALD	1.71E+01	< 5.70E+00	< 4.43E+00	< 6.65E+00	< 8.23E+00	< 8.86E+00	162	69.90
1513	FCT21AGALD	1.54E+01	< 5.56E+00	< 4.32E+00	< 6.49E+00	< 8.03E+00	< 8.65E+00	162	69.90
1514	FCT21ALALD	1.91E+01	< 5.20E+00	< 4.04E+00	< 6.07E+00	< 7.51E+00	< 8.09E+00	162	69.90
1515	FCT22ACALD	7.20E+00	< 3.01E+00	< 2.34E+00	< 3.52E+00	< 4.35E+00	< 4.69E+00	166	92.70
1518	FCT22ALALD	5.97E+00	< 2.90E+00	< 2.26E+00	< 3.39E+00	< 4.19E+00	< 4.52E+00	166	92.70
1522	FCT25ADALD	7.04E-01	< 2.59E-01	< 2.01E-01	< 3.02E-01	6.47E-01	2.59E+00	160	58.50
1524	FCT25ALALD	2.46E+00	< 3.41E-01	< 2.65E-01	8.71E-01	7.00E-01	4.35E+00	160	58.50
1602	FKA13ACALD	1.46E+00	< 8.75E-01	< 8.17E-01	1.05E+00	6.42E-01	1.34E+00	272	126.15
1603	FKA13ADALD	1.28E+00	1.07E+00	< 7.47E-01	< 5.87E-01	1.07E+00	2.45E+00	272	126.15
1605	FKA13ALALD	1.80E+00	1.22E+00	< 6.81E-01	< 5.35E-01	7.78E-01	1.94E+00	272	126.15
1606	FKA14ACALD	1.53E+00	8.16E-01	< 4.97E-01	6.74E-01	4.97E-01	1.17E+00	118	102.90
1607	FKA14ADALD	8.51E-01	6.39E-01	< 4.97E-01	< 3.90E-01	< 3.19E-01	< 6.39E-01	118	102.90
1609	FKA14ALALD	1.06E+00	< 6.03E-01	< 4.97E-01	5.68E-01	3.90E-01	< 6.39E-01	118	102.90
1611	FKA21ACALD	1.86E+00	< 5.61E-01	< 4.91E-01	< 3.86E-01	3.51E-01	8.77E-01	178	160.05
1612	FKA21ADALD	1.80E+00	6.83E-01	< 4.35E-01	< 3.42E-01	5.28E-01	1.21E+00	178	160.05
1614	FKA21ALALD	1.42E+00	< 5.30E-01	< 4.64E-01	< 3.64E-01	< 2.98E+00	7.95E-01	178	160.05
1615	FKA22ACALD	1.90E+00	5.99E-01	< 3.00E-01	5.35E-01	4.07E-01	8.13E-01	124	137.10
1616	FKA22ADALD	8.44E-01	4.67E-01	< 3.11E-01	< 2.44E-01	< 2.00E-01	< 4.00E-01	124	137.10
1618	FKA22ALALD	7.01E-01	4.07E-01	< 3.17E-01	< 2.49E-01	< 2.04E-01	< 4.07E-01	124	137.10
1624	FKA25ALALD	1.73E+00	< 4.71E-01	< 4.39E-01	< 3.45E-01	5.02E-01	1.41E+00	132	142.10
1702	FKT13ACALD	3.38E+00	< 2.23E-01	< 3.91E-01	< 3.07E-01	7.25E-01	1.45E+00	331	177.60
1703	FKT13ADALD	< 5.61E-01	< 8.97E-01	< 7.85E-01	< 6.17E-01	7.29E-01	< 1.01E+00	331	177.60

CONCENTRATION (TOTCONC) OF ALDEHYDES (UG/M3)

LABNO	FLDCODE	ACETAL (UG/M3)	ACROLEIN (UG/M3)	CROTONAL (UG/M3)	BUTYRAL (UG/M3)	BENZAL (UG/M3)	HEXANAL (UG/M3)	TOTCAL (NO.)	TOTMASS (KG)
1704	FKT13AGALD	6.11E+00	1.23E+00 <	7.85E-01 <	6.17E-01	1.23E+00	1.63E+00	331	177.60
1705	FKT13ALALD	3.24E+00 <	5.12E-01 <	3.98E-01 <	3.13E-01	7.67E-01	1.19F+00	331	177.60
1706	FKT14ACALD	2.81E+00	4.77E-01 <	3.34E-01 <	2.62E-01	7.63E-01	1.36E+00	577	155.55
1707	FKT14ADALD	3.82E+00	7.91E-01 <	3.26E-01	2.79E-01	8.15E-01	1.16E+00	577	155.55

CONCENTRATION (FIRECONC) OF ALDEHYDES (UG/M3)

LABNO	FLDCODE	ACETAL (UG/M3)	ACROLEIN (UG/M3)	CROTONAL (UG/M3)	BUTYRAL (UG/M3)	BENZAL (UG/M3)	HEXANAL (UG/M3)	TOTCAL (NO.)	TOTMASS (KG)
1102	PSM13ACALD	< 7.77E-01	< 1.00E+00	< 7.77E-01	< 2.05E+00	< 1.67E+00	< 1.28E+00	16	192.00
1103	PSM13ADALD	1.09E+00	< 1.09E+00	< 8.44E-01	< 2.23E+00	< 1.81E+00	< 1.39E+00	16	192.00
1104	PSM13ALALD	< 7.46E-01	< 9.60E-01	< 7.46E-01	< 1.97E+00	< 1.60E+00	< 1.23E+00	16	192.00
1106	PSM14ACALD	< 8.26E-01	< 1.06E+00	< 8.26E-01	< 2.18E+00	< 1.77E+00	< 1.36E+00	16	192.00
1107	PSM14ADALD	5.26E+00	< 1.25E+00	< 9.70E-01	< 2.56E+00	< 2.08E+00	< 1.59E+00	16	192.00
1108	PSM14ALALD	< 8.81E-01	< 1.13E+00	< 8.81E-01	< 2.33E+00	< 1.89E+00	< 1.45E+00	16	192.00
1110	PSM21ACALD	< 6.74E-01	< 8.66E-01	< 6.74E-01	< 1.78E+00	< 1.44E+00	< 1.11E+00	16	192.00
1111	PSM21ADALD	< 7.53E-01	< 9.68E-01	< 7.53E-01	< 1.99E+00	< 1.61E+00	< 1.24E+00	16	192.00
1112	PSM21ALALD	< 6.05E-01	< 7.77E-01	< 6.05E-01	< 1.60E+00	< 1.30E+00	< 9.93E-01	16	192.00
1114	PSM22ACALD	1.23E+00	< 9.24E-01	< 7.19E-01	< 1.90E+00	< 1.54E+00	< 1.18E+00	18	216.00
1115	PSM22ADALD	8.43E-01	< 9.48E-01	< 7.37E-01	< 1.95E+00	< 1.58E+00	< 1.21E+00	18	216.00
1116	PSM22ALALD	3.01E+00	< 7.53E-01	< 5.85E-01	< 1.55E+00	< 1.25E+00	< 9.62E-01	18	216.00
1202	FSM13ACALD	5.19E+00	< 4.19E-01	< 7.33E-01	< 8.91E-01	< 1.15E+00	< 9.95E-01	12	144.00
1203	FSM13ADALD	3.46E+01	< 4.19E-01	< 7.33E-01	< 8.91E-01	< 1.15E+00	< 9.95E-01	12	144.00
1205	FSM13ALALD	1.13E+01	< 4.31E-01	< 7.54E-01	< 9.16E-01	< 1.19E+00	< 1.02E+00	12	144.00
1206	FSM14ACALD	1.48E+01	< 9.11E-01	< 1.60E+00	< 1.94E+00	< 2.51E+00	< 2.16E+00	16	192.00
1207	FSM14ADALD	2.37E+00	< 1.00E+00	< 1.75E+00	< 2.12E+00	< 2.75E+00	< 2.37E+00	16	192.00
1209	FSM14ALALD	3.12E+01	< 8.91E-01	< 1.56E+00	< 1.89E+00	3.79E+00	< 2.12E+00	16	192.00
1211	FSM21ACALD	1.47E+01	< 9.79E-01	< 1.71E+00	< 2.08E+00	< 2.69E+00	< 2.32E+00	10	120.00
1212	FSM21ADALD	1.18E+01	< 1.05E+00	< 1.83E+00	< 2.22E+00	< 2.88E+00	< 2.48E+00	10	120.00
1214	FSM21ALALD	8.49E+00	< 1.10E+00	< 1.92E+00	< 2.33E+00	< 3.01E+00	< 2.60E+00	10	120.00
1215	FSM22ACALD	< 1.50E+00	1.80E+00	< 2.10E+00	< 2.55E+00	< 3.30E+00	< 2.85E+00	8	96.00
1216	FSM22ADALD	5.20E+00	1.85E+00	< 2.35E+00	< 2.85E+00	< 3.69E+00	< 3.19E+00	8	96.00
1218	FSM22ALALD	3.02E+00	< 1.10E+00	< 1.92E+00	< 2.34E+00	< 3.02E+00	< 2.61E+00	8	96.00
1221	FSM25ACALD	1.72E+01	< 1.25E+00	< 2.18E+00	< 2.65E+00	< 3.43E+00	< 2.97E+00	8	96.00
1222	FSM25ADALD	< 1.53E+00	< 1.22E+00	< 2.14E+00	< 2.59E+00	< 3.36E+00	< 2.90E+00	8	96.00
1224	FSM25ALALD	4.24E+02	< 1.26E+00	4.55E+00	< 2.67E+00	3.77E+00	< 2.98E+00	8	96.00
1302	FBB13ACALD	< 2.09E+00	< 1.67E+00	< 2.93E+00	< 3.56E+00	< 4.60E+00	< 3.97E+00	239	5.08
1303	FBB13ADALD	3.62E+01	< 1.71E+00	< 2.99E+00	7.68E+01	< 4.69E+00	< 4.05E+00	239	5.08
1305	FBB13ALALD	1.82E+01	< 1.73E+00	< 3.03E+00	< 3.67E+00	< 4.75E+00	< 4.11E+00	239	5.08
1306	FBB14ACALD	4.93E+01	< 1.88E+00	< 3.29E+00	6.34E+01	6.10E+00	4.69E+00	424	10.00
1307	FBB14ADALD	3.73E+01	< 1.66E+00	< 2.90E+00	7.68E+01	< 4.56E+00	< 3.94E+00	424	10.00
1309	FBB14ALALD	1.77E+01	< 1.63E+00	< 2.85E+00	< 3.46E+00	< 4.47E+00	< 3.86E+00	424	10.00
1311	FBB21ACALD	2.55E+01	< 1.20E+00	< 2.10E+00	1.95E+02	4.65E+00	3.00E+00	467	12.75
1312	FBB21ADALD	1.63E+00	< 1.19E+00	< 2.08E+00	< 2.52E+00	< 3.26E+00	< 2.82E+00	467	12.75
1314	FBB21ALALD	7.17E+00	< 1.15E+00	< 2.01E+00	< 2.44E+00	4.02E+00	< 2.72E+00	467	12.75
1315	FBB22ACALD	5.98E+00	< 1.09E+00	< 1.90E+00	< 2.31E+00	< 2.99E+00	< 2.58E+00	463	12.35
1316	FBB22ADALD	< 1.45E+00	< 1.16E+00	< 2.03E+00	< 2.47E+00	< 3.19E+00	< 2.76E+00	463	12.35

CONCENTRATION (FIRECONC) OF ALDEHYDES (UG/M3)

LABNO	FLDCODE	ACETAL (UG/M3)	ACROLEIN (UG/M3)	CROTONAL (UG/M3)	BUTYRAL (UG/M3)	BENZAL (UG/M3)	HEXANAL (UG/M3)	TOTCAL (NO.)	TOTMASS (KG)
1318	FBB22ALALD	< 1.46E+00	< 1.17E+00	< 2.04E+00	1.08E+01	< 3.20E+00	< 2.77E+00	463	12.35
1321	FBB25ACALD	4.15E+00	< 1.07E+00	< 1.87E+00	< 2.27E+00	< 2.94E+00	< 2.54E+00	382	11.53
1322	FBB25ADALD	< 1.32E+00	< 1.06E+00	< 1.85E+00	< 2.24E+00	< 2.90E+00	< 2.51E+00	382	11.53
1324	FBB25ALALD	7.69E+00	< 1.06E+00	< 1.86E+00	< 2.25E+00	< 2.92E+00	< 2.52E+00	382	11.53
1502	FCT13ACALD	2.27E+01	< 1.10E+01	< 8.59E+00	< 1.29E+01	< 1.59E+01	2.39E+01	160	58.50
1503	FCT13ADALD	3.79E+01	< 1.00E+01	< 7.80E+00	< 1.17E+01	< 1.45E+01	1.62E+01	160	58.50
1505	FCT13ALALD	3.08E+01	< 9.90E+00	< 7.70E+00	< 1.16E+01	< 1.43E+01	1.76E+01	160	58.50
1506	FCT14ACALD	4.54E+01	< 1.10E+01	< 8.59E+00	< 1.29E+01	< 1.59E+01	5.70E+01	163	75.60
1507	FCT14ADALD	9.99E+01	< 1.06E+01	< 8.22E+00	< 1.23E+01	< 1.53E+01	6.46E+01	163	75.60
1509	FCT14ALALD	5.60E+01	< 1.01E+01	< 7.83E+00	2.41E+01	< 1.45E+01	6.71E+01	163	75.60
1511	FCT21ACALD	2.25E+01	< 1.04E+01	< 8.09E+00	< 1.21E+01	< 1.50E+01	< 1.62E+01	162	69.90
1512	FCT21ADALD	3.42E+01	< 1.14E+01	< 8.86E+00	< 1.33E+01	< 1.65E+01	< 1.77E+01	162	69.90
1514	FCT21ALALD	3.81E+01	< 1.04E+01	< 8.09E+00	< 1.21E+01	< 1.50E+01	< 1.62E+01	162	69.90
1515	FCT22ACALD	2.34E+01	< 9.79E+00	< 7.62E+00	< 1.14E+01	< 1.41E+01	< 1.52E+01	166	92.70
1518	FCT22ALALD	1.94E+01	< 9.44E+00	< 7.34E+00	< 1.10E+01	< 1.36E+01	< 1.47E+01	166	92.70
1522	FCT25ADALD	9.16E+00	< 3.36E+00	< 2.62E+00	< 3.92E+00	8.41E+00	3.36E+01	160	58.50
1524	FCT25ALALD	3.20E+01	< 4.43E+00	< 3.45E+00	1.13E+01	9.11E+00	5.66E+01	160	58.50
1602	FKA13ACALD	2.00E+00	< 1.20E+00	< 1.12E+00	1.44E+00	8.81E-01	1.84E+00	272	126.15
1603	FKA13ADALD	1.76E+00	1.47E+00	< 1.03E+00	< 8.06E-01	1.47E+00	3.37E+00	272	126.15
1605	FKA13ALALD	2.47E+00	1.67E+00	< 9.35E-01	< 7.34E-01	1.07E+00	2.67E+00	272	126.15
1606	FKA14ACALD	2.28E+00	1.22E+00	< 7.43E-01	1.01E+00	7.43E-01	1.75E+00	118	102.90
1607	FKA14ADALD	1.27E+00	9.55E-01	< 7.43E-01	< 5.84E-01	< 4.78E-01	< 9.55E-01	118	102.90
1609	FKA14ALALD	1.59E+00	< 9.02E-01	< 7.43E-01	8.49E-01	5.84E-01	< 9.55E-01	118	102.90
1611	FKA21ACALD	2.63E+00	< 7.94E-01	< 6.94E-01	< 5.46E-01	4.96E-01	1.24E+00	178	160.05
1612	FKA21ADALD	2.55E+00	9.66E-01	< 6.15E-01	< 4.83E-01	7.47E-01	1.71E+00	178	160.05
1614	FKA21ALALD	2.01E+00	< 7.49E-01	< 6.56E-01	< 5.15E-01	< 4.22E+00	1.12E+00	178	160.05
1615	FKA22ACALD	2.71E+00	8.53E-01	< 4.27E-01	7.62E-01	5.79E-01	1.16E+00	124	137.10
1616	FKA22ADALD	1.27E+00	7.00E-01	< 4.67E-01	< 3.67E-01	< 3.00E-01	< 6.00E-01	124	137.10
1618	FKA22ALALD	9.99E-01	5.80E-01	< 4.51E-01	< 3.54E-01	< 2.90E-01	< 5.80E-01	124	137.10
1624	FKA25ALALD	1.83E+00	< 5.00E-01	< 4.67E-01	< 3.67E-01	5.33E-01	1.50E+00	132	142.10
1702	FKT13ACALD	4.28E+00	< 2.83E-01	< 4.95E-01	< 3.89E-01	9.19E-01	1.84E+00	331	177.60
1703	FKT13ADALD	< 7.11E-01	< 1.14E+00	< 9.95E-01	< 7.82E-01	9.24E-01	< 1.28E+00	331	177.60
1705	FKT13ALALD	4.05E+00	< 6.39E-01	< 4.97E-01	< 3.91E-01	9.59E-01	1.49E+00	331	177.60
1706	FKT14ACALD	3.59E+00	6.09E-01	< 4.26E-01	< 3.35E-01	9.74E-01	1.73E+00	577	155.55
1707	FKT14ADALD	4.94E+00	1.02E+00	< 4.22E-01	3.61E-01	1.05E+00	1.51E+00	577	155.55

This page intentionally blank.